

Tracts
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CANCER

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AND

PRECANCEROUS CHANGES

THEIR ORIGIN AND TREATMENT

BY

G. H. FINK, M.R.C.S., L.S.A. LOND.

MAJOR INDIAN MEDICAL SERVICE (RETIRED)



LONDON

H. K. LEWIS, 136 GOWER STREET, W.C.

1903

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With the Author's Compliments.

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CANCER AND PRECANCEROUS CHANGES

AND

THEIR MEDICAL TREATMENT.

INTRODUCTION.

IN June 1902, I forwarded a paper on "Cancer, its Probable Origin and Treatment," to the Right Honourable the Secretary of State for India, Lord George Hamilton, His Gracious Majesty the King-Emperor's representative of that great dependency of the Crown, at the India Office. I did so, feeling it my duty to lay any experience I had gained in England and in India, while in the Indian Medical Service, before the authorities at the India Office first, since Cancer is a subject which has received much attention of late, and His Gracious Majesty, Edward the Seventh, King-Emperor, has always shewn a deep interest in the health and well-being of his subjects over the wide universe.

The Right Honourable Secretary for India in returning my paper, requested me to submit the same to the Cancer Research Committee of the Royal College of Physicians and Surgeons, which I complied with, receiving a reply that the same would be placed before the Executive Committee of the Cancer Research Scheme at an early meeting. My object was to assist in the research into this disease, and I expressed my willingness to do so. I then received a reply from the Secretary to the Conjoint Board, that my name had been noted for the consideration of the Director of the Cancer Research Fund, and still later a letter, informing me, that when the Superintendent of Cancer Research was appointed, my paper was submitted to him; but that at the request of the Committee, he was proceeding immediately to Germany, to ascertain the position of affairs in that country so far as Cancer is concerned, and as soon as possible after his return, he would ask me to call and see him and discuss matters, and that no time would be lost in communicating with me.

I was then asked to meet the Superintendent on February 17, 1903, at the Hall of the Conjoint Board of Examiners, which I did, and placed my views before him, as far as I could, in the time allowed. The Superintendent also requested me to give a sketch of the mode of investigation which I intended to follow, and it would then be considered.

Cancer has received much attention of late, and there has been a great deal of theory and speculation as to its *causa vera* and treatment, which cannot of course be wondered at, considering the difficulties to be met with. Speculation and theory are in my

opinion unavoidable, though a healthy sign, so long as they are consistent with the doctrines of Medical Science which can be supported by scientific facts. At any rate, they enable us to separate the grain from the chaff, and to build up a better structure out of the materials placed at our disposal.

Cancer has been probed from all sides. Scientific as well as popular theories have brought the question with far greater prominence and earnestness before us, and thus helped to focus this fearful malady more clearly before the full gaze of the public; and as co-workers in the field in the cause of humanity and science, as the grandest evidence of the advancement of human knowledge, we have shewn the purpose of our research, namely, to gain a combined victory over a disease which has so far baffled all our efforts.

My object in writing these pages is to deal as consistently as possible with the probabilities in the life history and development of Cancer as far as their knowledge at the present time permits, and not to go over all the theories and statistics, since much has been written and eloquently described by various authorities in books and journals of medical literature, and it would be superfluous to cover the old ground over again. But I hope from time to time to touch upon the most salient features, and refer to them as necessity occurs, with a view to elucidating my theory regarding this disease in consistence with the laws of Parasitology and Cancer phenomena.

It seems to me, that unless the life history be considered from the beginning, *i.e.*, from the humblest plant and animal life, which combine with the forces of nature, by taking advantage of the sanitary and hygienic defects which exist among us, though unrecognized as such, we should be attacking the problem from its most difficult point, in refusing the most natural channels of entry and attack. It is the flaws and defects of the present day which we refuse to recognize as such, because of their seemingly trifling appearance, and not the progress of sanitation in civilization which create the soil, the pabula and ferment. When these are ready-formed, the entry of the seed is the work of chance or accident, for it then enters the suitable host or soil, propagates, grows, and develops to its fullest extent, then decays, degenerates and dies; and, in so doing, creates further ferments, which form still more suitable pabula after death, for the parasitic germs of Cancer to live and exist, either in a "dormant" or "latent" form, or in an active or "motile" condition.

Man's body is the centre towards which all the forces employed in Nature's laboratory, without and within, are impelled. It is here that the conflict between the healthy and unhealthy, the good and the evil, in the great battle of life against disease and death, is waged, the last scenes of which are sometimes agonizing in the extreme, and often terribly disastrous and acute. Our united efforts are therefore necessary in delivering the attack in this fearful conflict, for then, and then only, may we hope to focus the enemy with the searchlights of science, when the complete victory shall be ours, and the goal attained, for the good of the human race and family.

I.

A General Survey of Cancer.—Cancer is the most formidable disease at the present day, and fills a prominent place in medical science and thought. Its position in the human body is almost impregnable, for it has defied all that medicine or surgery, in their widest sense, could achieve in the discovery of its *causa vera* and treatment.

Listerian principles of antiseptic surgery have, however, opened the gates in a large measure for tactical operators in the field, while bacteriology and the Röntgen rays have brought their searchlights to play on the camp to discover the stealthy yet rapid movements of the enemy.

We are still, however, pressing on in our enquiry into this scourge of civilized times, which is advancing with a heavy mortality in all countries. One writer, however, cheers our path, with the consoling remark, that it is the "penalty of sanitary progress in civilization"; this, if accepted, strikes a heavy blow to the benefits conferred upon mankind in general, through our measures of sanitation, cleanliness, and antiseptics. I think, however, that it might also imply, that our sanitary progress and hygiene have not arrived yet at that stage of perfection which still remains for us to achieve. Their faults and flaws (if I might so term them) require fuller investigation before passing an indictment on sanitary progress as the cause of cancer spread and mortality. No man is perfect, no government is perfect, and even our sanitary system cannot be said to be perfect!

Bacteriology has disclosed silent, yet wonderful processes at work in our blood and tissues—those channels of conveyance and resting places for germs and ferments to live, elaborate, and be conveyed into our system, as a rule, accidentally—by absorption, respiration, ingestion or inoculation; but bacteriology might be said at the present time to be in its mere infancy, though its growth is steady and progressive.

Our failures, we are told, in advancing towards the discovery of the origin and treatment of certain diseases of a grave character is "too much individualism in scientific work, and the result is not only waste of power, but actual loss of knowledge which is allowed to die with its discoverer, because he could not get a hearing for it, or because it failed to find favour in the eyes of some superior person."

If we cannot all gain titles, degrees, and distinctions, then let it at least be said of us, that we have helped to gain them for others, for humanity and the noble cause of medicine.

The astute campaigner, we are told, who is so fond of quietly annexing the baggage amid the sulphurous fury of the scientific combatants in the field of investigation, should no longer have exclusive honours showered upon him, when we should cease to have Betty's praise for labours not her own whispered in our ears.

II.

Paget's Definition of Cancer.—Paget tells us, that “cancers are manifestations of certain specific and morbid states of the blood, and in them are incorporated peculiar *morbid materials* which accumulate in the blood, and which their growth may tend to increase.”

This is suggestive of (1) a soil; (2) a seed or germ; (3) pabula and nutrition for the growth, development, and increase of the germ.

Let us, therefore, first consider the theories of cancer; the histology of the normal connective tissues, their growth, development, vascular, nervous, and lymphatic supplies; and the statistics relating to this malady, for they are all intimately woven into the pathology of the disease forming its groundwork in our investigation.

III.

Theories of Cancer.—It is not necessary to enter into all the theories of cancer, *in extenso*, for they are pretty well known to those interested in the subject, and are most eloquently told by many writers, among them Dr. Herbert Snow of the Cancer Hospital at Brompton. Nevertheless, it is very necessary to refreshen our memories somewhat, by hearing what the chief ones are.

A. *The Inclusion Theory of Cohnheim.*—Cohnheim attributed the malignancy of cancer to embryonic “*residua*” or “*nests*.” These are clusters of cells in foetal life which should have become one or other of the normal tissues of the body, but failed to do so, and exist as cells throughout childhood into adult life. Suddenly they undergo an increase, and multiply under “some unknown stimulus,” giving birth to a mass of new cells, and thus all the phenomena of cancer.

Dr. Snow has three objections to this theory, viz.:—

1. That cancer prevails most in organs and tissues where no embryonic “*residua*” can be seen under the microscope, or otherwise, and says it is impossible to believe in the existence of such in the mamma and uterus of the female, and the buccal mucous membrane of the male.

2. Clinical experience and statistics by many modern authorities show that it is impossible to ascribe ordinary cancerous disease to any element of heredity in the progenitors of the individual.

3. The vital argument against heredity, viz.:—“No cancer ever arises without an obvious exciting cause, whether there have been cancerous ancestors or not.”

Dr. Snow, moreover, carefully informs us, that the “cancer of the adult” is here referred to, and this applies to some 98 per cent. of the gross total.

B. *Congenital Cancer (Blastomata).*—Snow acknowledges that Cohnheim's hypothesis has some ground for the remaining two per cent., and has given these the term “blastomata.” In these, he

further tells us, "there is a difference from ordinary cancer, since they do not require an exciting cause," and that these tumours often "seem to grow spontaneously." Moreover, their structure is different, and they are not sufficiently numerous apparently, to affect the statistics of cancer; but they cannot be neglected by any investigator of cancer phenomena and their laws. That the course of the "blastomata," he further affirms, affords material in support of the autositic theory of cancer of the ordinary class. From the above it would be inferred that cancer, like erysipelas and tetanus, might be considered as of traumatic and of idiopathic origin.

Regarding Snow's objections to Cohnheim's theory, there seems to be some good reason for raising the same. One of the objections disposes of the idea of embryonic "residua" or "nests," since no such residua occur where the favourite sites of cancer are found (mamma, uterus, and buccal mucous membrane). At the same time embryonic residua or nests, wherever they exist, whether in the actual sites of cancer or not, might be capable of taking on fermentative processes, such as glycogen or animal starch (in the liver, muscle and colourless blood corpuscles and embryonic tissues), and transmitting the same by absorption to distant regions of the body, through the blood and lymphatics, where there are no embryonic residua present, but which are the actual sites of cancer.

Wherever there is a tendency to congestion and determination of blood, or wherever microscopic lesions or cysts are to be found, there the transmitted ferment from embryonic residua are capable of helping on cancer development and malignancy by chronic irritation, inflammation, and germ or cell implantation. Such a process is quite consistent with the laws of cancer and the doctrines of medical science in its relation to parasitology and inflammation.

With regard to cancer heredity to which Snow objects, although heredity in this sense which Snow describes, might not be directly responsible for cancer, surely there might be a predisposition which can be handed down from parent to offspring, which is only made manifest by habits and surroundings which the latter contract or are placed in? Removal from such conditions would lessen the chances of the constitutional or hereditary taint. For example, twins born of cancer parents, the one removed to a tropical region, the other remaining in a temperate one, might in the middle period of life shew different results as to their respective liability to cancer, through the one being removed from the natural "habitat" of that disease, whilst the other is left in it.

Then, with regard to congenital cancer (blastomata), Snow acknowledges that Cohnheim's hypothesis has some ground for the remaining two per cent. to which he has given the term "blastomata." We understand by this, that the actual sites of embryonic residua are attacked in the remaining two per cent. of the rest of the cases which become manifest in the favourite sites of cancer, where no such residua exist. Although the sites do not contain the residua or nests, they might be the situations which are predisposed by heredity, owing to active functions and determination

of blood, and are therefore capable of arresting the ferment from the embryonic residua which are at a distance, and attacking these sites, because constitutional or hereditary taints are brought to light and developed, and chronic inflammation set up, owing to certain habits and surroundings which cause a physiological change in the secretions and excretions of the particular part attacked—the one is the mechanical and the other the chemical force. A bee might visit every flower in a bed; but it lingers longest at the ones from which it sips the nectar, and its lingering or arrest is the danger.

Hereditary weaknesses need not pronounce themselves in precisely a similar way or in precisely the same spot, for we know that mental weakness might become manifest in children or co-relations in a variety of forms, some suffering from hysteria, others mania or idiocy; but not necessarily the actual disease in the parent.

The “some unknown stimulus” referred to by Cohnheim in the shape of grief and anxiety long-continued, might act as a ferment and chronic irritant, much in the same way as anger or emotional excitement or depression in a mother causes changes in the milk secreted in a mother’s breasts, setting up irritation, diarrhœa or “thrush” in the suckling infant. Why? Because of some unknown ferment which is formed.

Over-fatigue, physical or mental exhaustion, certain emotions, if long continued, certainly must act as irritants, disturbing rest and lowering the vitality generally by creating insomnia and nervous debility. It is the nervous system which controls and governs the functions of the human economy, and when its vitality is lowered ferments are formed, which act as a poison to the system.

C. Pangenesis.—A suggestion by Darwin that every cell constituent of the body, not too highly differentiated, emits gemmules which retain characteristics of the parent cell, that these are concentrated in the reproductive elements and pass to the offspring, and thus the peculiarities of the cancerous parent are believed to be handed down to the descendants. Snow considers these gemmules absolutely hypothetical and negatives it by the same strong *à priori* objection he gives to Cohnheim’s theory.

If a ferment can be formed which alters the quality and quantity of secretions and excretions, interfering with the physiological functions, then the same ferment might be capable of entering the cells, and by a solvent action detaching them and then rendering them capable of being taken away to distant parts where lesions exist, which are points of arrest, and here they might be capable of assuming forms which resemble certain peculiar cells. Moreover, all fermentative processes are accompanied with certain peculiar organisms or parasites which might resemble the cells of the part, and thus evade detection.

D. Dr. Creighton’s views, which deal with “varying degrees of secretory forces” affecting the normal processes of evolution. A feeble force or stimulus generates carcinoma, a stronger one “sarcoma,” and a still stronger one “myxoma” or “enchondroma,” and so forth.

This theory is one, which though possessing a grain of truth in its application to the female breast cancer, which is one of the

several phases of aberration in a natural process, is only fit, we are told, for study from the "antiquarian point of view."

According to Snow, I feel it is rightly consigned to this category if cancer be considered merely from this aspect, and not from one which is specific, the specific cause being either a germ, ferment, or abnormal secretion or excretion, or a combination of these which gives rise to a highly organized acid or chemical.

E. *The Microbe Theory*.—By bacteriology and the microscope Snow considers it the "*fashion*," and so one which is predominant; but "prone to be carried into conspicuous excess." He also gives certain reasons to show that long before maladies, proved to be due to "micro-parasites," were demonstrated under the microscope, there were conditions pointing to a contagious element through presumptive evidence; and also where like conditions of soil and climate affected a number of persons simultaneously who were exposed to these similar conditions at the same time.

Snow, moreover, tells us, that numerous investigators have sought to bring cancer "into a line with such maladies as leprosy and tubercle." That a large number of reported "cancer parasites" have been described, and that it has hitherto proved impossible to demonstrate that the microscopic appearances so styled, are organisms at all, much less that they bear any causal relations to malignant disease lesions.

Amid all the mass of evidence which various observers have offered, namely, propagation by contact; by "haunted dwellings"; increase of cancer cases and mortality in towns situated on rivers which periodically overflow their banks; dampness of soil, &c., regarding which Snow seems sceptical, it is as well not to commit oneself too early by rejecting what is to be seen under the microscope, especially in the case of those who offer good reasons and interpretations as to what they see with the help of that instrument. Presumptive evidence is all very well, but positive or objective evidence is the one which medical science asks for.

If it be the fashion as Snow tells us, to adopt the microscope, surely it is a useful addition to our "armamentarium" of diagnosis of subjective and objective symptoms and physical signs. If we neglect to make use of so powerful an aid to our sense of vision—of minute objects, invisible to the naked eye—we must admit that we might be found as culpable of neglect in refusing to prescribe spectacles for our patients or for ourselves in a case of myopia or compound astigmatism. If the interpretation of what some have seen under the microscope be due to a mental astigmatism, it does not follow that all are so affected. With so large a number of workers in the field, we must sooner or later arrive at a correct solution to the problem. If one does not employ the aids we have to the solution of the same, our methods might also be considered open to the objection of being "antiquarian," a charge I do not think we wish foreign investigators to hurl at us. Considering the matter, then, from all its varied aspects, we should proceed to our task without being one-sided in our views regarding this disease and its causation.

F. *The Autositic Theory*.—That the human body is wholly composed of cells and of products formed within the cells. Its complex

machinery has been built up, we are told, from a single cell as the starting point. Starting with this point, we begin with that tiny mass of substance like jelly, known as "protoplasm" and the "amœba," which is a tiny animal which maintains an independent existence.

The autositic theory ascribes cancer to a "reversion of the natural cells or cell elements to that primitive amœbiform condition from which all have emerged," and in which a few still persist. Each cell then casts off "its allegiance to the nerve centres," which cease to exert over it the least control. It becomes a "quasi-independent parasite," or rather "autosite."

The numerous species of cancer depend on the particular kind of cell subjected to this morbid reversion, the cancer process. Snow considers this a good working hypothesis, and states that in favour of it, much positive evidence can be found.

What is this evidence?

1. With the aid of the microscope, we are told, the individual cells of any cancer can be distinctly seen to erode the parts with which they come in contact.

2. Clinically, the new growth flourishes at the expense of the surrounding tissues; remotely, at the cost of the whole body. Transplanted to distant regions of the organism, the same happens.

3. Some palpable derangement or perturbation of the central nervous system is the all-but invariable precursor of the most prevalent forms of cancer.

Those not due to such an exciting cause are immediately preceded by conditions interfering with local nutrition, such as chronic inflammation or congestion.

4. Exactly as age advances, and the nerve centres descend the grade of vitality, we find progressively increased liability to malignant disease.

5. Those organs which are intimately correlated with emotional states, contribute by far the larger majority of cancer cases.

6. The female, who is more emotional than the male, is more liable to cancer, and would be more conspicuous, were it not that pernicious habits in the male counterbalance this to a certain extent.

7. Often cancer development dates from a sudden shock, fright, attack of paralysis, or influenza.

8. The most predominant of all cancer factors is mental distress, anxiety, and trouble.

9. There is a tendency for benign tumours to become cancerous as age advances, and the energy of the nerve centres decreases.

10. Some tumours after years of benign growth, display a malignant course.

11. Wherever in the body cell proliferation is specially active, we look for cancer, viz., the mammæ and uterus, glands and epithelium of the digestive tract, periosteal coverings of bones, hair-follicles, eyelids.

12. The spontaneous development of "blastomata" has been referred to as an argument supporting the autositic theory.

Cancer, Snow tells us, is in no sense of the word a constitutional disease, and the only drugs which "arrest" its career, are

"neurotics," having a special influence on the cerebral nerve-centres. Is this latter statement to be accepted in the sense of a cure or a palliative for cancer? The sufferer if deprived of the subjective symptoms, temporarily, has certainly gained, inasmuch as pain has been mitigated; but, if the active changes and growth of diseased tissues have been *arrested*, through that "*unknown stimulus*" (which excites through the nervous system, by long-continued grief, anxiety, or mental depression, a ferment which produces from morbid nutritive action, a chronic disease, from dyspepsia to cancer), being neutralized or destroyed, then we might congratulate ourselves that we have advanced a step further. But the question is, whether we can regard narcotics in this disease in the light of agents which neutralize the effect of the cancer germ or ferment.

The "quasi-independent parasite," or "autosite," which is an amœbiform or plasmodial jelly-like substance, is, I believe, quite as capable of introduction from without, under favourable conditions of habit and surroundings in the individual, as the reversion of the natural cells or cell elements to that amœbiform condition which Snow describes, and from which all have emerged and a few still persist.

In the gradational scale of life, it is probable that the "quasi-independent parasite" seizes its favourable opportunity, through certain flaws and defects in hygiene and sanitation, and develops into a "mycetozoon" or "protomyxomyces," which form of life has a wonderful power of adapting itself to its environments, casting off allegiance to the protophyta, and claiming allegiance to a life akin to protozoa after passing through a number of changes in the external world of lower animals and insects, when it ultimately reaches the human body and rests there, until the conditions arise in middle life which are favourable in every way, when it develops into a growth which is subject to degeneration and decay, especially at the "menopause" or middle period of life, when the tissues of the body generally undergo a change, and their general vitality is lowered through changes in the nervous system with loss of nervous control. At such a time there is a hyperplasia or overcrowding, exuberant growth of low forms of tissue, subject to metamorphosis through alterations of the physiological functions, and the supply of morbid ferments and pabula.

The active principle of mucoid or gelatinous tissue (mucin), exists not only in embryonic tissue, but in various other regions of the body. The mucoids allied to mucin, exist in ovarian cysts and dropsical effusions. Are not these ovarian cysts or dropsical effusions capable of being formed in parts of the body undetected for a long time, in the same way as echinococcus cysts may exist for a long time undetected, producing morbid appetites, hysterical attacks, &c.? If into these cystic formations, certain germs or ferments enter, they are capable of exciting growths, and then dying within these growths without a trace of their former structures.

I feel that the above statement is quite consistent with the laws of parasitology and bacteriology.

The extra-corporeal life or stage of cancer is capable of intro-

duction into the human body in the same way as the "plasmodium" and "flagellated body" in malarial fever.

In the investigation of cancer, too much stress appears to be laid on microscopic sections of diseased or dead tissue after staining, whilst the appearances in the living blood and lymphatic system, and the chemical pathology or chemico-bacteriology of cancer seem not to have received that attention which they justly demand.

Certain of the "flagellated infusoria" and "monadinæ" parasitic in man are to be found in mucus lumps in various parts of the human body in sites which are favoured by cancer. Cunningham describes the same as developmental stages in the life-history of a "myxomycete" which he calls "protomyxomyces coprinarius." In connection with the same, there are certain diseases which act as predisposing causes, bringing about the creation of these germs and a peculiar ferment which they elaborate in the system, owing to certain habits, including the alcoholic, and also owing to flaws in our hygiene and sanitation.

The life history of the "*Amœba coli*" remains yet to be unravelled, together with its mode of reproduction. It has been found in dysenteric stools associated with remains of food, red and white blood corpuscles, detached intestinal epithelium, and cell fragments, and a great number of bacteria, micrococci and monads. Steinberg has alleged the discovery of an amœba ("*A. buccalis*") in the mucus covering the teeth of man. Grassi also speaks of an "*Amœba dentalis*" observed by him in three cases, which is said to resemble "*A. coli*" and to become quiescent at low temperatures.

Cunningham has observed the occurrence of amœba in the human intestine as well as in the cow and horse.

IV.

Statistics relating to Cancer.—These are to be seen in various works on the subject of cancer, as well as the recent statistics given in the *British Medical Journal* which contain a comparative statistical study of cancer mortality given further in these pages.

V.

Histology of the Tissues in Cancer Development.—In dealing with cancer, it is necessary that the histology of the normal connective tissues, their growth and development, should be considered.

(a) The tissue which needs special consideration is the mucoid or gelatinous form, found chiefly in Wharton's jelly (the bulk of the umbilical cord), and also in other situations in the fœtus, and in certain stages of development of connective tissue in various regions of the human body. It consists of nucleated cells which branch and form "trabeculæ" in which a jelly substance contain-

ing the principle of mucus or mucin, albumen in smaller quantities, but no gelatin is found. This latter point is most important in the artificial culture of cancer "microbes" or "parasitic life" and their ferments, and which culture medium seems the one which is to be selected for the purpose.

(b) Retiform connective tissue which is found in every part, is the framework of some organs, and enters into the constitution of many mucous membranes. In many parts and between the fibres of this form of tissue, rounded granular corpuscles are found which are thus called "lymphoid" or "adenoid" tissue.

(c) Basement membranes were formerly considered homogeneous; but are really a form of connective tissue: they are supporting membranes of the epithelium, secreting glands and other situations, and by staining, the flattened cells are seen to present an epithelioid arrangement of connective tissue cells. In some parts they give off branching processes which join with those of other cells and form a network instead of a continuous membrane.

VI.

Important Phenomena in Cancer.—The phenomena of inflammation are also interesting to note in connection with cancer, especially those pointed out by Metchnikoff in capillary circulation and the emigration of leucocytes or "phagocytes" which devour the irritant body if a micro-organism, or remove the tissues killed by the lesion and so make place for a regeneration of the tissue.

In many cases, we are told, that the microbic or chemical influence over the tissues is too powerful for the phagocytes, when they are vanquished or destroyed, and the dead phagocytes collect in the tissues and form pus.

But in the chronic process a "cheesy degeneration" or "caseation" occurs, and the caseous masses may soften and become irritating after long quiescent periods and be eliminated by suppuration. Other changes are also liable to occur depending on the length and situation of such quiescent period where these caseous alterations take place. These changes would be especially interesting to study in the histology and production of cancer phenomena of various degrees or types, from the colloid to the melanotic, which depend no doubt on the histology of the tissues and the cells present, together with peculiar habits and surroundings in the individual which set up the ferment if long-continued, and bring about malignant results.

In chronic infectious diseases, these changes are far graver in character when the epithelium, stroma, round-celled infiltration, the phagocytes, vessels and nerves, together with "*certain bodies*" included in the cells and free in the tissues, are involved.

In dealing with the processes at work, certain changes occur by fermentation leading to caseation, which prepare the soil for the seed or germ, which in its new environment sets up still further alterations of a chemical, chemico-pathological, or bacteriological character.

VII.

Mr. Plimmer's Opinion.—Mr. Plimmer tells us that the histology of cancer has a great likeness to chronic infectious diseases, and that it runs the course and presents lesions of chronic infectious disease; that the tumour is the result of the reaction of the healthy organism against the endocellular parasite of cancer. He further tells us, that the characteristic mark of cancer is the proliferation of epithelial cells, and the epithelium is always derived from pre-existent epithelium in the part where cancer begins; that they change their anatomical characters in some degree, and are not physiologically or morphologically "atypical," but differ in size, and can find their way into any other part of the body possessing differences in staining property.

One cannot but agree with Plimmer that cancer has a great likeness to chronic infectious disease; but as to the tumour being the result of the reaction of the "*healthy organism*" against the endocellular parasite, the question is one which might be considered still under discussion and requiring demonstration.

The epithelium, moreover, might presumably be derived from pre-existent epithelium in the part where cancer begins; but there is nothing to prevent a transplantation of certain cells or organisms from a distant part to a point where there is a lesion, and this might be from a residual embryonic nest containing the active principle of mucus or mucin which has undergone those "other changes" spoken of before in connection with inflammation.

One of the strongest characteristics of cancer is its rapidity of growth, and its tendency to break down after a certain stage and to ulcerate, creating a foul putrescent odour; and if interfered with surgically, to produce secondary growths. It also undermines the surrounding tissues, poisoning the whole system with its discharges, creating a peculiar starvation of the body which results in the cancerous cachexia. On removal by operation, one of the features is a repetition of the growth, either locally near the site of the operation, or at a distance, by metastasis or metamorphosis.

These latter features point to a particular soil in which cancer grows and develops more readily and to greater advantage, and this soil need not be always inherited; but may be acquired by certain habits which create the ferment.

It also points to certain pabula either created in the soil within, or introduced from without, or through external causes operating by environment, which affords a further additional nourishment for the up-keep of the pabula or nourishment for the development of cancer. At a later stage in the development of the disease, the whole system is permeated or saturated through the blood and tissues, giving rise to the cancerous cachexia by an auto-infection.

Most probably a specific ferment is created for each particular form of cancer which is capable of travelling to other parts of the system, carrying along with it certain cells which are detached, and whose morphological characters are assumed by the parasite which creates the ferment; or it enters into the cell and there loses

its identity because of its homogeneous or hyaloid character. Through some such process, if long-continued, there is an irritation which brings about further alterations in the physiological functions of the part where the cells are arrested, which, though temporary at first, are capable of becoming permanent, through peculiar habits in the individual which are highly favourable for the whole process of development. The healthy organism is no longer healthy; but predisposed to degenerative changes through loss of resistance and power of phagocytosis at the "menopause" in women and the middle period of life in man.

VIII.

Cancer Constitutions.—Certain constitutions at certain periods of life, by heredity or acquirement, are capable of predisposing to cancer development or precancerous conditions. On such soils cancer would flourish more readily or to greater advantage, and perhaps more rapidly than in others, since there is not that resistance offered by the blood. This strange action, in certain constitutions, might account for a tumour or growth being benign at one time, and then, suddenly, through some perturbation created by a bad habit contracted which upsets the balance through loss of nervous control; or perhaps through some chronic infectious disease which acts as an explosive cause, it takes on a malignant nature.

Gout, rheumatism, syphilis, all weaken the system and render the blood less powerful to resist, and have to be considered in intercurrent attacks of other diseases of an infectious type. They might also render the sequelæ of certain chronic infectious diseases "latent" or "dormant" in the system, until a favourable opportunity offers, when they assume virulent characters. Such a condition might be regarded as an indefinite incubation period for cancer. We know that hydrophobia has no fixed incubation period, and a bite from a rabid dog might remain dormant for some long period before the grave mischief through some indefinable cause becomes manifest. What is the reason for this? I do not think it has been clearly demonstrated.

Age, sex, occupation, habit, climate, season of the year, rainfall, temperature, locality, topographical conditions, and defective hygiene and sanitation, must all have a strong voice as factors in the production of cancer. At any rate they are to be considered as necessary in predisposing to cancer.

We are told that the vegetarian Hindoo of the East is as prone to cancer as his flesh eating brother; but the authority for such a statement has not been revealed by the "Practitioner" in the special cancer number for April, 1899.

We must be careful to distinguish the term "Hindoo" from "other castes." The latter are regarded, sometimes, by those unacquainted with the Hindoo castes and sects, as Hindoo, which is a mistake, for they are usually classified among the humblest castes, which scarcely touch the fringe of Hindoo society. They are gross feeders as a rule, some even indulging in the flesh of

animals that have died from disease, so that these castes (Chamârs, Dangârs, Mehters, Cômjurs, Nâts), must be carefully excluded from the term "Hindoo."

I mention this particularly, as I have seen neoplasms, such as sarcomata, lymphadenomata, &c., among Hindoos, mistaken for cancer, whereas acute periostitis, which I have also seen among Hindoo children, has been sometimes mistaken for sarcoma, especially near the growing ends of bones.

Tumours are now classified with greater care than they used to be thirty or forty years ago, and growths which were once regarded as cancerous are no longer looked upon as such.

When I make the above assertion, I do not wish to be misunderstood that the term cancer has been applied to neoplasms, such as sarcomata and lymphadenomata by those who use the microscope as a rule to confirm their diagnosis. What I mean is, that true carcinoma is to be seen among the lowest castes, known as "other castes," and the novice in the caste systems and sects in India, has defined the term Hindoo as opposed to those who are not Christian or Mahomedan.

Sometimes it is very difficult to diagnose the characteristic features between the above diseases, especially if the medical history be not properly investigated, or the patient be too reticent; also in cases which have had no proper or skilful treatment, but have fallen into the hands of the village "hakim," "baid," or "jhurrah" (village barber).

I think it is very necessary to point out the care which is essential in not only diagnosing the disease correctly, but of obtaining a clear statement of the medical history, as well as the caste, of your native patient, since this is a clue to his occupation, surroundings, and past life, which assist one considerably in forming some idea of the disease he suffers from. No tumour under twenty years of age is now regarded as a cancer, and as a rule, cancer in India, will be found to prevail chiefly among the lowest castes who are gross feeders. Sarcomata and lymphadenomata are to be seen among the higher castes, though not exclusively confined to them.

Periostitis is seen among all castes, and must be carefully distinguished from the above tumours, although in the later stages, or through neglect or maltreatment in the village, it often becomes a difficult task for the physician or surgeon to diagnose a case, without exploring and examining the tissues under the microscope.

It seems to me, that in children and young adults, the physiological strain in the body is directed towards the selection of constituents from the blood, to create the growth of the skeleton and the protective tissues of the body respectively, hence, in children, there is a greater liability to periostitis and sarcomata (tumours of connective tissues), while in middle life and advancing years, the internal organs, including the digestive, generative organs, and the brain, which are taxed more severely for maintaining the balance, there is a tendency for cells to degenerate rapidly at the "menopause," when the physiological secretions and excretions are dislocated, or become capricious as it were, (if I may so use a term), because the body is less active, hence there are certain ferments formed which operate through the

nervous system on the cells, and give rise to hyperplasia, overcrowding, and metamorphosis, since elimination cannot keep pace with regeneration of tissues, and there is a great strain thrown on the whole of the organs. Irritating secretions are then created and carried to distant parts, and wherever the strain is most felt, there, growths of an unhealthy character are formed owing to the combined alterations in the physiological secretions through the ferments created at the "menopause" or middle period of life. At such periods, it is well known, that the nervous system and appetite are capricious, or inclined to be morbid, hence we cannot wonder at the tissues sharing in these peculiar changes, since body and mind act and react upon one another.

IX.

Defects, Deficiencies, and Habits, in Cancer formation.—Defects and deficiencies lead to functional disturbances, which assume a chronic character, rendering the parts, where such occur, more liable to cancer, especially at a certain age or period of life, and in people addicted to the abuse of alcohol which upsets the digestive functions and balance of the system, thus adding fuel to the fire as it were, through the effete material which is formed, and which has to be expelled.

In my student days, I remember while clinical clerk in one of the London hospitals, seeing an aged man admitted as an in-patient for what was supposed to be cancer of the stomach from its medical history. Shortly after his admission, it was discovered that the patient had no teeth, and had been used to bolting his food. A set of artificial teeth were then provided, and all signs of cancer disappeared shortly after, the man returning home a happy creature. Similar cases among edentulous patients have doubtless occurred in other hospitals as well as in private practice.

Cancer has come to be so dreaded, that even the very least semblance to that disease strikes terror into the hearts of some, and acts strongly through the nervous system as a ferment, disturbing and dislocating the physiological secretions, and setting up morbid alterations. Unless a confirmed diagnosis by careful examination is made, and the tissues submitted to the microscopic test, I feel it is unwise to pronounce a case to be cancer if it bear the mere semblance to that disease.

I have said before, that there is a particular constitution or soil on which cancer will grow and flourish to greater advantage. I further believe that the alcoholic habit is one of the prevailing factors in temperate and cold regions, which creates the soil by causing alterations in the blood and tissues with the aid of certain surroundings and habits which act as the sparks in this disease. I do not mean to imply that the temperate use of alcohol is at all responsible, but the abuse. In certain constitutions it acts rapidly through the nervous system, and transmits nervous weaknesses from parent to offspring which become manifest, and so the soil in early life becomes predisposed to cancerous changes which lead to growths of a malignant character in later years.

A still further predisposition is liable to occur at certain periods of life in women, and the middle period in man, when repair and regeneration of cells and tissues cannot keep pace with the rapid changes leading to degeneration, decay, and destruction; when the cells become distorted and dislocated, lose their normal functions, and are ready to break down.

Dr. Bennett in his well known work on "Nutrition in Health and Disease," says, "For the nutritive process to take place in a normal manner, the blood must be healthy and there must be a due supply of nervous power." The process itself appears to be essentially a vital one, each tissue forming itself and repairing its waste from the same blood element. Each particular tissue has its average duration of life and then degenerates and dies, to be superseded and replaced. The entire series of nutritive processes take place under the direct control of the nervous power of the individual, an important physiological fact which explains the influence of nervous exhaustion and depression in producing diseases of nutrition. The molecular elements of the tissues of which the animal economy is composed are constantly dying, being resolved into the chemical elements and are as constantly renewed.

This renovation, this repair, takes place principally, as well as the original formation, out of the nitrogenous elements of the blood, the albumen, and fibrin. But if the physiological balance be disturbed by pouring in excessive nutriment, which has to be expelled through the organs of excretion, it must, if long-continued, disturb, dislocate, and disorganize the cells and tissues of the whole machinery creating changes at the points of greatest strain, by a damming or heaping up of the particular part of the body where the effete material accumulates rapidly and cannot find an easy outlet, hence, a foreign growth or tumour which assumes a malignant type, and is Nature's method of casting off what is useless.

The physiological effects of alcohol may be said to be stimulation of the nervous system, organic combustion, and elimination of carbonic acid and water, with evolution of heat, and the arrest or diminution of destructive metamorphosis.

Small quantities of alcohol ingested are burnt, and thus create heat, whilst large quantities are, to a great extent, eliminated.

Wine differs from spirits in containing less alcohol and more water, vegetable acids and volatile ethers, along with a vinous extractive principle which have a separate stimulating power on the nervous system.

The stimulating power of wine, therefore, is not to be measured by the mere amount of alcohol it contains. The volatile ethers and the extractive principle participate in the stimulating influence it exercises on the nervous system. Burgundy contains 21.5 per cent. of alcohol, and yet by many persons the latter, we are told, is found to be fully as potent as the former, and is probably due to the greater predominance of the ethers. Champagne is always fortified and sweetened by the addition of alcohol and syrup: its alcoholic strength thus varies greatly.

All wines, Bennett says, contain vegetable acids free, viz., acetic, tartaric and racemic acids. The proportions in which they

are found are considerable, the presence of these acids is more or less apparent according to the amount of sugar contained in the urine.

The stomach of wine drinkers has to dispose not only of diluted alcohol, but also of considerable quantities of free acids, sugar and volatile oils, which often disturb the digestion when taken in large quantities.

Malt liquors, generally, differ from spirits and wine in containing in addition to alcohol a certain proportion of saccharine matter that has not been transformed into alcohol during the process of fermentation along with some soluble gluten derived from the grain, gluten being the nitrogenous element in grain, and sugar the carbonaceous.

The alcohol contained in beer varies according to the kind of beer. In the strong ales, the proportion of "alcohol" is about the same as in the lightest Continental wines.

These are points which are important to remember in connection with mucoid tissues and mucin, which vary in composition and reaction from the different sources whence obtained. Halliburton tells us that there are probably several mucins, but they all agree in the following points:—

(a) Physical character—viscid and tenacious.

(b) Precipitability from solutions by acetic acid—they all dissolve in dilute alkalies like lime water.

(c) They are all compounds of a proteid with a carbo-hydrate called animal gum, which by treatment with dilute mineral acid can be hydrated into a reducing but non-fermentable sugar, the nature of which is at present uncertain.

The mucoids differ from the mucins in either being non-precipitable from alkaline solutions by acetic acid, or in being readily soluble in excess of acetic acid.

One of these, *ovo-mucoid*, is found in white of egg, and others called *pseudo-mucin* and *para-mucin* are sometimes found in the fluid of ovarian cysts and dropsical effusions.

Dr. Pavy has shown that a *small* quantity of a similar carbohydrate can be split off from various other proteids, classified as simple proteids.

The *nucleins* and *nucleo-proteids* are also worthy of study in this connection, and are compounds of proteid with a complex organic acid called *nucleic acid*, which contains phosphorus. During loss of nervous control this acid is probably very much disturbed. On decomposition it yields phosphoric acid and various bases of the xanthine group.

Nuclein which is the chief constituent of cell nuclei is allied to mucin in its physical characters, but chemically it contains a higher percentage of phosphorus, hence on decomposition of the phosphorus from the cell nuclei of the brain on nervous exhaustion and loss of nervous control, there is a larger yield of phosphoric acid.

These various processes which conjointly contribute to the nutrition and preservation of the human economy are all under the influence of the nervous system. It is through the influence of the brain and other nervous centres that the entire digestive and nutri-

tive functions, as well as all the other functions, are carried on and efficiently performed, hence healthy nervous influences are indispensably requisite for healthy nutrition to defy the elements.

But if they are imperfect it crumbles to pieces, and although the physician may continue to repair it, it is in vain.

With good nutrition and digestion regulated by healthy nervous influences, the human body can stand the shock of adverse influences; but if the food is bad or badly selected, too scanty, or over abundant, and the animal tenement or house built up of bad materials, it succumbs at once to adverse influences. Alcohol and food, therefore, are very powerful factors in considering cancer causation.

Alcoholic stimulants in the shape of beer, wine, spirits, &c., may be taken with positive advantage, if in moderation, we are told by Bennett, especially in Northern and temperate latitudes, by the healthy members of the community.

When alcoholic beverages are taken in excess by healthy persons, and often when they are taken in moderation by persons suffering from disease or from disturbance of the digestive organs, the stimulating effect produced on the stomach is injurious, and the function of digestion is, consequently, improperly performed. The result is the formation of imperfectly elaborated chyle, unfit for the purposes of organic reconstruction, hence the tissues and cells are easily invaded by animal and vegetable parasites.

The over stimulation of the digestive organs by alcoholic stimulants is often followed by irritation of the mucous membrane of the stomach, and is shown by the dry, hot state of the tongue the day after the excess.

The various dynamic perturbations, trembling, paralysis, different forms of mania (delirium tremens), hallucinations, weakening of the intellectual faculties, are probably connected with permanent changes produced in the tissues of the nervous centres.

When alcohol in excess enters the general circulation, its ready combination with the oxygen of the blood interferes with the functions which the blood-oxygen has to perform, viz., its combination with nitrogen to constitute the protein compounds which form the tissues, and its combination with the carbon and hydrogen of effete tissues and of the food, which it thus burns and eliminates from the economy. It exercises thus a direct influence in retarding molecular disintegration or the destructive metamorphosis of tissue. The consequence is that the blood becomes loaded with effete nutritive elements, the result of imperfect chylickation and nutrition, and of the non-elimination of the products of vital disintegration of the tissues, among which "*materies morbi*" carbon occupies a prominent rank, we are told. The liver and skin, also emunctories for carbon, come to the aid of the lungs, but in vain, since the contamination is constantly renewed. The ingestion of alcohol in any shape has been proved to notably diminish the amount of carbonic acid exhaled, no doubt by interfering with the destructive metamorphosis of tissue, and this in itself must poison the tissues and act as irritants through the nervous system.

Bennett, moreover, tells us that the human body suffers from

defective nutrition through an over-supply of food. This may seem paradoxical, nevertheless the fact that in the middle and upper classes of society more human beings suffer in health and strength through taking too much food.

When the supply of food is unlimited, there is the general tendency to take more than is necessary.

The agricultural population is the longest lived section of any community, and yet they live on a very small quantity of food, even in England.

An over-supply of food ingested, is not necessarily injurious at the time; but it either passes away through the intestinal canal as undigested or waste, or it is transformed as usual into chyle. In the latter case the overplus carbonaceous element is either deposited in the cellular tissue as fat, or burnt by its combination with oxygen, and excreted by the skin and lungs as CO_2 or eliminated by the liver as bile.

The overplus nitrogenous element is thrown off by the kidneys as urea, uric acid, or urate of ammonia. It is necessary to mention here that uric acid is not made by the kidneys; when the kidneys are removed uric acid continues to be formed, and accumulates in the organs, especially in the liver and spleen. The liver, we are told by Halliburton, has been removed often from birds, and uric acid is then hardly formed at all, its place being taken by ammonia and lactic acid. It is, therefore, probable that ammonia and lactic acid are normally synthesised in the liver to form uric acid. The principle conditions, we are told by the same authority, which lead to an increase of uric acid in the urine are:—

1. Increase of meat diet and diminution of oxidation processes such as occur in people with sedentary habits.

2. Increase of white corpuscles in the blood, especially in the disease known as leucocythemia. This latter fact is of great interest, since leucocytes contain large quantities of nuclein; nuclein yields nitrogenous bases which are closely related to uric acid.

The dangers of the accumulation of adipose or fat are, that the person becomes obese, unwieldy, and unwilling to move. The will or mental power, and the power to take exercise, fail. There is mechanical interference with the proper action of the organs, by a fatty degeneration.

At the middle period of life there is a tendency for fatty infiltration and degeneration to take place, which adds to mental torpor and loss of control over the nervous system, which is one of the necessary factors in the development and growth of tumours of the malignant type, such as cancer.

Exercise and diet alone, carefully regulated, can combat against such a tendency. On the other hand the individual must guard against exhaustion through exercise which creates imperfect digestion owing to want of nervous power.

Organic tissues which are built up from badly elaborated materials, contain within themselves, we are told, the seeds of disease. Constitutional and hereditary taints are brought to light and developed, and chronic inflammations are set up.

We might, I think, safely conclude that cancer, which is allied

to chronic infectious diseases, and attended with certain important cancer phenomena, such as inflammation, is preceded by changes of this nature, which is the storing up of tissues elaborated from materials which are bad, hence, in some cases hereditary taints are brought to light, and tissues formed, which readily develop into new growths through the action of peculiar ferments and organisms, which at first sight might be innocent growths; but which assume a malignant type later, when suitable pabula are created later for organisms to enter, and in the presence of certain acids and ferments create growths which degenerate and rapidly break down, and then infect the whole system. As long as fresh materials are continued to be added to the blood, and certain bad habits, including the alcoholic, are indulged in and kept up, such growths will continue to advance rapidly.

Cancer might, therefore, in some cases, be considered a disease which is brought out constitutionally through badly elaborated materials in a person predisposed to malignant disease by a hereditary taint, or it is a local manifestation of a general disease which is acquired in the same manner as boils, carbuncles, and abscesses, in a person who becomes diabetic and neglects to treat the latter by strict dietary and altered habits in life. "Dull care then sits at the board and poisons the food."

X.

What Proofs have we of Cancer Spreading?—"Some most impressive and alarming figures, showing how widespread cancer has become, are contained in a special report just issued by the Registrar-General of Marriages, Births, and Deaths, in Ireland. Throughout the world the devastation of human life from this cause is increasing. Ireland alone lost 2,893 of its citizens through cancer in 1901, being at the rate of 6.5 per 10,000 of the population. In county Armagh the death-rate is as high as 10.2. The steady increase in the recorded mortality from cancer in all three portions of the United Kingdom is very remarkable:—

"In Ireland, in 1864, the first year in which the registration system was in force, the rate of mortality from cancer was 2.7 per 10,000 living. In 1871 it had risen to 3.2; in 1881 to 3.7; in 1891 to 4.6; and in 1901 it reached 6.5.

"In England (including Wales), in 1864, the rate was 3.9. In 1871 it was 4.2; in 1881, 5.2; in 1891, 6.9; and in 1900 it had risen to 8.3.

"In Scotland, in 1864, the rate was 4.3; in 1871 it was 4.4; in 1881, 5.2; in 1891, 6.8; and in 1900, 8.0.

"Europe tells the same tale. The mortality is growing year by year, in spite of all medical science can do. In Bavaria the rate has risen in the past ten years from 8.9 to 9.9; in Holland from 7.9 to 9.3; in Norway from 6.1 to 9.2; in Austria from 5.4 to 7.0; in Prussia from 4.5 to 6.1; and in Italy from 4.3 to 5.2. The same steady increase is recorded in America. Women suffer slightly more seriously than men, and the disease is most fatal in those advanced in life. In many cases those attacked are carried off

with remarkable rapidity. In 1901, 776 persons in Ireland were not ill more than six months; and 873 for less than a year. No explanation is furnished of the fact that the disease is most fatal among farmers and labourers.

"The observations of registrars, which are appended, may or may not be of great medical value, but it is not without interest to note the general opinion that the disease attacks most frequently those who live in damp houses or who reside in a district with a damp subsoil, while hereditary tendencies exist in many cases. Many of these reports attribute the prevalence of cancer to the clay pipes, often dirty, which the small farmers and labourers use, the rough stems irritating the tongue and lips, but in the case of women the illness is laid at the door of the strong tea which they drink (in some instances seven times a day), while in both sexes alcohol is said to predispose to the disease. From a mass of medical evidence which he has collected, the Registrar has found that cancer recurs in the same family, and that it appears in families suffering from tuberculosis, lunacy, idiocy, and epilepsy. In some cases the disease has occurred in persons who have been in direct contact with cancer patients, and more than one case of cancer has occurred amongst different families living in the same house, or amongst successive occupants of the same house, while in a few instances the disease has appeared in different houses in the same locality about the same time. Unfavourable conditions as to residence, food, &c., appear to be frequently responsible for the appearance of cancer."

The above are the figures recently published which show that cancer is on the increase in every civilized country.

This formidable array of figures and statistics points to a high rate of mortality from this terrible disease. Whether it is real or apparent, or due to our more intimate acquaintance with this affection, it indicates the necessity for a correct diagnosis of cancer.

Cancer has, within the last 30 or 40 years, been differentiated from neoplasms such as sarcomata, and the latter, though malignant, have not the true characters of cancer.

Any tumour of a malignant type before the age of twenty is no longer regarded as a cancer, since this disease is unknown under that age according to the latest definition of the complaint.

Phthisis and other chronic infectious diseases which formerly caused a high mortality among young people are said to become manifest as cancer at a later period of life. The victims of phthisis and chronic infectious diseases that were carried off at an early age now survive, hence the alleged increase of cancer.

The above statements prove at any rate, that cancer has received closer attention of late years by the medical profession whose figures supplied to the Registrar-General of Statistics, have largely contributed towards formulating the accurate statistics which we now have with regard to this malady.

The lessened mortality from phthisis and chronic infectious diseases is largely due, I believe, to physical and mental training and a better knowledge of the elementary rules regarding the causes that lead to consumption, together with an increased desire

for an outdoor life to what used to exist. The wise laws for the control and regulation of labour forces in trade and commerce, have also given the young the benefits of purer air and healthier standards of living on the whole, and there is a far greater appreciation of such from year to year. On the other hand, it is worthy of enquiry whether the outdoor life has not been more conducive towards a greater liability or chance of the *materies morbi* of cancer reaching the human body through excessive consumption of food and waste in the system, which acts upon the nervous system, and through the latter, on the cells, tissues and organs of the body in the presence of germs taken in from the external air, especially in some places where the atmosphere on analysis contains pulverized stable manure chiefly, which may be carried great distances by the winds and waves, and which require an incubating period and certain conditions of the nervous system at particular periods of life for their action and conjugation of their chemical constituents, which must necessarily form in the organic chemistry of the human body, when there is an upbuilding of carbohydrates into the "protoplasmic molecule."

The conditions of life have also created a harder struggle in the daily existence of people, and in consequence the strain of mental worry and anxiety of living is felt more keenly now, and has contributed—most probably together with other factors—to an increased mortality from cancer, owing to the "hurly-burly" life with little time for properly digesting or assimilating food which undergoes a process of fermentation and imperfect elaboration in the system, creating conditions suitable for germ decomposition in the alimentary canal to contribute their share in time towards cancer development in later life through the flaws and defects of sanitation and hygiene, which must be reckoned with, and which cannot be called "sanitary progress in civilization" in the true acceptance of that phrase.

Progress in sanitation has removed many diseases, and lessened others in these civilized times, why then should cancer be an exception? The causes must then be sought elsewhere, amid the flaws and defects as well as the habits of life.

XI.

The Predisposing Influences in Cancer.—1. Cancer attacks people in largest numbers in the middle period of life, when the habits become sedentary and there is a tendency for abundant formation of fatty tissue with fatty metamorphosis generally through lowered vitality and loss of nervous control. In the same way as rennet ferment with caseinogen undergoes coagulation, forming cheese or casein, so there is a particular form of fermentation which creates a highly organic acid, which on decomposition yields phosphoric acid. The action of this acid causes a conjugation between glucosamine and a proteid, which glucosamine is derived by boiling the chitinous shells of crustacea with hydrochloric acid, and is also formed from a molecule of grape

sugar or other hexose by the replacement of an OH group by NH_2 , and which is capable of occurring in the human body in the presence of parasites and the changes they undergo.

At the middle period of life or the "menopause," the mental strain and worry in life are greatest; the tissues are undergoing severe changes; the physiological or healthy balance of the system with the secretory and excretory forces which help to maintain the same, are sharing in the general though disturbed metabolism, when there is a severe shock to the whole system shared largely by the nervous system.

At this period too, the elasticity of body and mental vigour are lessened, and the same amount of outdoor exercise short of fatigue is not taken in the open air for the maintenance of the healthy standard as before, hence there is less oxygen or ozone taken in and carried by the blood to all parts of the system, which element is a purifier or sustainer and a destroyer of noxious materials through active phagocytosis. The withdrawal therefore of this element largely predisposes to the inroads of disease from external as well as internal causes, especially if the carbonaceous and nitrogenous elements, with the hydrocarbons, be in excess in the food and drink and cannot be burnt up or eliminated quickly.

At the middle period of life there is a far greater tendency for parasitic or fungoid changes to occur, since there are conditions induced in people advancing in life with sedentary habits to attract such germs. Moreover, people who live sedentary lives, also live as a rule under bad hygienic conditions consuming large quantities of highly nitrogenous food without exercise in the fresh air.

2. The influence of hysteria and marriage are interesting to enquire into in their respective relation to cancer, and statistics might be formulated on the following points:—

(a). Whether cancer attacks married or unmarried people more commonly before or at the middle period of life.

(b). Would hysteria, hypochondriasis, and allied affections, be regarded as predisposing to precancerous or cancerous changes, at, or before, the menopause or middle period of life in man or woman, since at such a period the nervous system seems to lose its control and become morbid?

(c). Do primipara, multipara, or sterile women respectively, suffer more than the unmarried?

(d). Does cancer become more manifest in cases where Nature's laws of procreation are hindered or checked, by causing a sudden arrest, distortion or dislocation, a disappointment or suppression of the healthy physiological functions of the body?

(e). Would sexual excess or frequent miscarriage so affect the nervous system, and create morbid changes, secretions, and growths, leading towards cancerous development?

(f). Would disordered menstruation, late marriages, and leucorrhœa predispose towards cancer of the breast and the organs of generation?

(g). Would the attendance of unqualified persons at accouchments, or the neglect of antiseptic precautions and meddlesome

midwifery, set up conditions in both mother and child at this period of high susceptibility to cancerous growths or influences through fermentative materials in the atmosphere and water of certain places being injected *in utero*?

We know how susceptible the mother is at this period, and how the umbilical cord so rich in mucoid tissue, might likewise become charged with the "materies morbi," which are conveyed to parts of the body and act as ferments, or lie dormant for an indefinite period till suitable conditions arise in later life through environment, age predisposition and the "menopause." These are points which must, I feel, be considered in cancer of the generative organs in the female as well as the male.

3. *Geography of the Cancer Fields*.—Mr. Alfred Havilland, in Parts I. and II., page 400, of the "Cancer" number of the *Practitioner* for April, 1899, mentions the cancer fields of England and Wales.

In page 404 he says: "It will thus be seen that the cancer fields of England are to be found in the sheltered and low-lying vales traversed by fully formed rivers, in sites liable to floods and composed of the more recent geological formations in which clays of different ages predominate."

In page 405 he states: "The essentially chalky county of Hampshire is remarkably free from cancer; its rivers, the Test and the Itchen, have their origin in the chalk hills."

After giving a brief outline of the facts to which the coloured map of cancer among females during the years 1851-60 seemed to point, and to warrant certain generalities which he sums up under 1, 2, 3, and 4, he says in page 406, under 4, "that geologically, the low mortality districts were characterised by the oldest palæozoic rocks, especially those of the carboniferous or limestone period, the liassic, oolitic and cretaceous limestones."

He further states, in page 416, "Thus at the end of this brief sketch of the medical geography of cancer, we find ourselves asking the same question that rose to the lips of my audience in November, 1868, 'How is it that limestones are always associated in England and Wales with the lowest mortality from cancer, and flooded clays with the highest?' The question still remains unanswered, and will so remain until the subject is taken up in earnest by the medical profession, for it is a field, I find after thirty years of working in it, that cannot be made to produce fruit without the toil of many labours. When the above question is answered light will begin to fall on the cause of cancer."

Cancer, therefore, in many points might be said here to resemble malaria in the conditions present for the production of that disease, although the one is a disease in temperate and cold regions chiefly, the other in the tropics; but exceptionally the two diseases might be said to be present in either regions in particular localities.

In India it is the low lying, flooded districts, or those subject to floods at certain seasons of the year with a clayey soil, in which malarial fever breaks out at the beginning, and again after the rainy season.

The cancer fields or districts are said to be in such areas in

England and Wales, although to some extent there has been contrary evidence found on these points. But in giving a decision, each case must have its medical history carefully enquired into, for the simple reason, that persons might contract malaria in the plains of India, and seek rest and change in the hills where they die from this disease; but this would not be conclusive evidence that the malarial fields are on hill tops.

4. *Residence*.—Various observers in England, Germany, and France, have expressed opinions which are suggestive of “cancer haunted” or infested dwellings.

Dr. D’Arcy Power believes in its transmission through locality; but not through houses or water. He gives as his opinion, that there is a “contagium vivum” which is to be found in a vegetable or animal organism which finds a suitable “habitat” in the human body and thus approaches somewhat to the mosquito-malarial theory.

With regard to the influence of locality and the similar conditions existing in malaria and cancer respectively, it has been found that cancer haunts localities which are well wooded and watered, which is suggestive of a vegetable or animal organism, or both, which find a suitable “habitat” in the human body. It is difficult to imagine the influence of mere locality in producing cancer, without the other necessary organisms or growths resulting from climatic and local conditions, for in that area or locality there are certain favourable atmospheric and telluric conditions which help on the propagation and germination of insect and parasitic growths (both animal or vegetable), “protozoa” and fungoid, or “mycetozoa” or “protomyxomycetes.” These latter, can scarcely be called the predisposing cause or causes, but are rather the exciting or immediate causes of cancer.

5. *Certain Diseases*.—There are probably certain diseases of a chronic infectious type, which favour the appearance of cancer, by creating dyspepsia, diarrhœa, dysentery, or even choleraic conditions which bring about a favourable state of the mucous membranes and thus encourage parasitic changes of a vegetable and animal character. Certain benign tumours or cysts also render the necessary culture medium and pabula for the germs or parasites of cancer to flourish in, and these become malignant under suitable conditions in certain constitutions.

There are other infectious diseases which might also favour cancerous growths similarly, such as typhus fever, peritonitis, icterus, and pneumonia, for reasons to be mentioned later.

XII.

London Air.—Before taking up the exciting causes of cancer and the precancerous conditions, it is necessary to mention here that the manufacturing towns are not considered favourable sites for cancer.

London air and traffic which causes dust is worthy of mention here. The Hon. Rollo Russell in an article on fogs in the

Nineteenth Century and After gave the constituents of London air after examination; the matters suspended in it are as follows:—Fragments of hay, pinewood, linen and cotton fibre, feathers, skin, vegetable and animal matter. In the streets the principal constituent he tells us, appears to be “finely ground stable manure,” I would also add *soot*, in the winter. Compared with ocean air microbes in the proportion of 13,000 to 1 are present. If we consider this fact, there seems to be every opportunity for germs or parasites which enter the mouth, the air-passages, and the alimentary tract to proliferate and create changes which are predisposed through mechanical strain or lesions in certain constitutions, and wherever there is heat and moisture of the right degree to encourage such.

The cancer parasite or germ is most probably a fungoid growth, “mycetozoon” or “protomyxomyces,” rapid in its development, with a wonderful power of adapting itself to its environments and simulating the tissues and cells wherever it is implanted or develops, and may be transmissible through the air, soil or water by inhalation, ingestion or inoculation direct, or by means of insects. Owing to peculiarities in the regions it settles in, and adaptation to its environments in the human body, it is hard to detect with the naked eye or microscope; but it is capable, doubtless, of causing alterations and physiological changes which necessarily bring about a certain degree of morphological alteration from its original form, which are influenced also by loss of nervous control. Their presence acts as a foreign body in a normal tissue or organ, creating chronic irritation and inflammation with growth of an exuberant character ready to break down, degenerate and turn malignant, owing to further parasitic changes setting in subsequently through altered general metabolism.

This change is most likely created in distinct stages which covers a period of years, during which the preparation of the soil goes on when eventually a fungoid growth, “mycetozoon” or “protomyxomyces” appears setting up a decomposition and a growth of a malignant nature which is cancer.

In tropical countries where malarial fever abounds, we have an analogy in certain parts of the tropics where the “primitive bodies” of malaria first create anæmia in apparently healthy persons, prior to the outburst of malarial fever subsequently in newly-arrived Europeans (West Africa). Then again, we see as the result of filariasis (*Filaria sanguinis hominis*), changes which lead up to rapid growths and dropsical effusions of a peculiar character. These facts serve as an analogy for the points which I wish to elucidate further on with reference to cancerous growths being preceded by leucocythæmia and leukæmia, of which the distinct forms of this complaint lead to results related to one another in certain respects; but differing in degrees of malignancy, and difficult to disperse by treatment.

In the case of animals also, we shall find that there are peculiar diseases which attack them, creating dropsical effusions, ulcerations and growths. “Surra,” a disease of horses is brought about

by a "hæmatozoon," described by Lewis, which closely resembles *Cercomonas* (Dujardin).

The opinion of Cunningham in connection with the parasitic "flagellata" is worthy of closer investigation, and I think that if the development be regarded as a stage in Nature's laboratory in the life history of a myxomycete (*Protomyxomyces coprinarius*), and that the cercomonads (at least the parasitic forms) after encapsulation become amœbæ, which fuse together, we have some further light thrown on the subject of cancer which brings us to a "hæmatozoon," in which the *Cercomonas* (Dujardin) is the nearest relation we can produce.

XIII.

Is Cancer communicable by Human Agency?—

Zacutus Lusitanus considered cancer transmissible by direct contagion, and quoted the case of a poor woman with ulceration of the breast who slept with her three sons, two of whom died of cancer, and the third also suffered, but was cured by operation.

The above case might point either to heredity, direct contagion, or conditions favourable through locality, residence, and similar surroundings, in predisposed constitutions.

Tulpius said, "Cancer ulceratus juxta ac oculorum inflammatio contagiosus est." This would mean either contagion or infection, inoculation or epidemicity in origin, depending very much of course on the particular form of inflammation referred to. The *causa vera* of each of these, and the particular form of inflammation of the eye referred to in the quotation, as to whether simple conjunctivitis, or ophthalmia of a severe or dangerous type, requires enquiry into before the complaint is properly treated, since the technique in the treatment of each of these forms must be carefully followed ere we may hope for a salutary change or cure. In some cases the measures have to be heroic before the inflammation is subdued.

But caustic treatment with AgNO_3 in solution is the sheet anchor of most forms of inflammation of the eye, the caustic solution, or a ring of changes of various caustics in various degrees of strength in solution, being applied in a particular manner.

The caustic treatment for cancer has been in a large measure unsuccessful, and in some cases decidedly harmful, so that the simile used by Tulpius, is one, which is scarcely applicable to the disease cancer proper as defined at the present time.

J. Juncker, pupil of Stahl, we are told, also believed cancer to be contagious, and for a successful engrafting of this disease, it was necessary that the infective material should fall on a suitable spot where there is already a breach of surface. There is doubtless some truth in this, but I do not believe that it is transmissible into healthy living tissues of the human body in the same way as syphilis and other contagious diseases.

The communicability of cancer by inoculation has failed so far, inasmuch as the experiments on animals mentioned by Shattock and Ballance show.

There must be, in my opinion, a condition produced first, which is unhealthy, or a foreign growth present—whether it be a pimple, abscess, fissure, ulcer, benign tumour or cyst—with foreign material as a pabulum, suitable for the growth of the fungus or parasite of cancer which ultimately develops into a “mycetozoon” or “protomyxomyces,” or enters the body as a growth or parasite of this character. If the *materies morbi* of cancer enter into the above foreign growths, they will develop, grow and be retained and prove auto-infectious later on through fermentative changes after even a long period, in the same way as caseation and caseous masses prove irritating after long quiescent periods.

Velpéau regarded the contagiousness of cancer as possible, but not demonstrated. Since then, there are several others we are told, who have submitted *prima facie* evidence of the transmission of this disease.

From all this evidence we cannot but feel that the question of its communicability through human agency causes many to lean towards its capability of communication from one person to another by contagion or infection, if the suitable conditions, either constitutional, local or accidental, be present, together with climatic, atmospheric, and geographical. Cancer might under such circumstances be regarded as communicable by human agency, and also for other reasons to be hereafter mentioned.

It is necessary here to explain this:—for instance, a person with cancer in Europe proceeds to India, resides in the hottest part of that country where the climate is extremely dry and hot (120° F. in the shade), with a rainfall, say, about one inch in the year, the chances are, that the cancer is arrested or held in check, but he cannot communicate it to others residing here. But if he goes to a colder region where the air is moist and damp, such as the hill stations, he probably gives the cancer a stimulus or chance of developing and can communicate the disease to others.

Similarly, a large cancer mortality district or cancer field where the bodies of cancer cases are buried, gives every chance for the cancer parasite to develop to advantage, and by subsoil drainage or action of the ground water the fungus or parasite is brought to the surface during periodical inundations by rivers overflowing their banks. When the drying process once more occurs, the parasite or fungus clings to algæ, crustacea (water-fleas), and other terrestrial and aquatic insects which find their way to animals which graze in such meadow or pasture lands, and thus to man who feeds on the flesh of such animals, or comes into close contact with them as companions and friends in the field of sport or hunting, and also while sharing his domestic life.

In those localities where cancer fields exist, there are certain prolific conditions which harbour the humblest forms of plant, animal and insect life, favouring their cycle of existence or life-history.

This life is closely and intimately produced from stage to stage from the fungoid to the protophyta, protozoa and the mixed forms peculiar to the locality or geographical area which attracts the peculiar insect life which bears them, and which develops within them for the eventual infection of the lower animals and man.

Man's body is the centre therefore towards which all these forces are impelled in the gradational scale, and in the measure in which he exerts his intellect and the facilities offered for the exercise and study of the combined forces through scientific processes of enquiry, so will be his triumph or victory. The cessation of enquiry into these forces, even for a time, is to lose in the race for supremacy in the works of creation, which the Creator has designed for His own pleasure, for man's education and the working out of his salvation.

XIV.

Is Cancer a Disease of the Lower Animals?—Dr. MacFadyean has brought to light the fact, that animals are subject to cancer which was supposed to be confined to the human race alone. The only animal in which he has not found it, is the pig, which, in its anatomy, resembles man.

The close supervision exercised by man over the pig whose flesh is an article of food common in Europe, has introduced a very high degree of sanitation among this class of animals, whose habits are too well known since the days of "tænia" and "trichinosis."

MacFadyean informs us of the rarity of cancer of the uterus and mammary gland in animals, and he states, that he has never seen the uterus and udder of the cow affected with it, which fact he considers as remarkable and difficult therefore to reconcile with the irritation theory which is commonly said to be the exciting cause of cancer of the breast. I presume, the irritation meant, is in the act of milking the cow; but this is an imitation of the act of suckling performed by the calf, which is healthy, for it empties the glands, hence, it cannot be regarded as an irritation. Were this act not performed and the gland not emptied properly at regular intervals, then there would be the chance of irritation through lactic acid fermentation and perhaps caseation in the lactiferous ducts, which would extend to the lobules, acini, and cells.

In the case of the human female, if the lactation be suspended, or the mother is not able to nurse her infant, but is obliged to wean it before the proper time causing a cessation of the flow of milk either suddenly or unnaturally, we must consider the condition induced and the presence of lactose in the urine as suggestive of its abnormal quantity in the system.

The changes and alterations created in this sugar of milk in connection with the acids and ferments in the system, lead up to lactic acid and eventually to butyric acid fermentation, creating further alterations in the morphology of the tissues and cells of the body, which are conducive to irritation and which need not be immediate, but might occur after a quiescent period.

The animals MacFadyean has seen cancer present in, are the horse, mare, dog, bitch, ox, cow and sheep. These are man's favourite companions, and also make up his nitrogenous food supply to a very large extent; whilst the dog, which is his most

frequent companion among animals, is found to live in his dwelling, and sometimes with the horse in the stables as one of the family.

In this list, the horse and dog, two of man's most favourite companions in life that share his domestic comfort and add to his enjoyment and exercise, are most commonly affected with cancer as compared with the rest of the animals named. This might probably be due to similar surroundings which man and his companions share in their domestic life and contact, and so become infected through similar local and residential causes.

Fatigue and exhaustion in such animals, owing to the circumstances in their life (in the field and in the chase) undoubtedly act upon their nervous system far more detrimentally than on the other animals mentioned, and the wear and tear of life therefore in their case is far more severe. Besides this, these animals are not used as man's food as a rule; but are permitted to live to that particular age when cancer becomes manifest through lowered vitality and loss of nervous control, hence their greater liability to cancer than the other animals.

XV.

"Bursatee" in the Horse in India.—The disease known as "bursatee," in the horse in India, regarding which so little is known, comes from the word "bursat," signifying "rain" in Persian. Its name implies some connection with the rainy season and damp.

Mr. Horace Hayes, M.R.C.V.S., in his book on "Veterinary Notes for Horse Owners," page 68, gives the symptoms of this disease, and he says, that in old and neglected cases these sores may continue open, more or less, all the year round, and that a horse which has, or has had, "bursatee," should be regarded as unsound, for the simple reason that these sores are liable to break out again and again. Is this not considered in some respects similar to cancer?

Mr. Hayes's book, referring to this complaint, is well worth perusal, in order to see the many points in it which resemble cancer in man, and we cannot neglect to study the same since so little is known of this disease.

"Bursatee" occurs in certain low lying damp localities in India, and generally through the rainy season, especially among horses whose stabling, food, and watering, are not properly attended to. The stables are damp and dark, infested with rats, flies, and beetles which are attracted by urine and dung heaps.

Never does it attack horses whose surroundings and stabling are carefully attended to, and where flies are excluded by hanging lattice curtains over the doorways.

This disease also resembles "rodent ulcer," and is almost as obstinate to treatment, especially in aged and badly nourished horses.

The sores appear in the region of muco-cutaneous surfaces and over the fetlocks of the animal. They spread superficially and cover a large surface sometimes from which a grumous substance

comes away in thick caseous lumps which doubtless forms excellent pabulum for future generations of disease germs.

XVI.

Delhi Sores or Boils in Man.—The “Delhi sore” known also as the “oriental sore,” and other names as well, resembles “bursatee” in many respects, and appears chiefly on the face. They are caused through bites of the “sandfly,” an insect very like a small mosquito found in certain districts in India.

According to native “hakims” and “baidis,” when the disease appears in man, it is said to protect him from malarial fever.

Sandflies or “simulidæ,” like the “culicidæ” and “chironomydæ,” are eminent blood-suckers. They are more troublesome than gnats. In England there are a few species, of which *two* are generally distributed. The term mosquito is sometimes applied to a “simulium,” sometimes to a “culex.”

The “phlebotomidæ” allied to the above family (culicidæ), are blood-suckers also: they are extremely common insects, especially “psychoda phalænoides” whose larvæ inhabit dry cow dung and decayed vegetable matter. It is popularly, though erroneously, called a midge.

The above insects come under the order “diptera,” which are divided into three great groups or sections. One of the sub-sections under the group “proboscidea,” and known as “nemocera,” has a family the “mycetophilidæ,” that are chiefly fungus eating flies, which feed on decayed vegetable matter in their larval condition. Their larvæ are common in the growing stems of hollow-stalked agarics.

The “cecidomyzidæ” or gall gnats, are also worthy of notice. The larvæ feed on various living plants, some form galls, others feed on decayed wood.

The above insects are all worthy of careful study as vehicles most probably of the parasites or parasitic fungi of cancer, and especially in their relation to the “monadinæ” which occur in ulcers and fissures, as well as foreign growths within the body at certain periods, and also in connection with dyspepsia, diarrhoea, and dysentery, together with other chronic infectious diseases.

XVII.

Malaria, Delhi Sore, “Bursatee,” and Rodent Ulcer or Cancer.—It is necessary to mention certain points of interest on the subject of malaria and certain ulcers found in man and the horse in India, which bear resemblance to rodent cancer.

Some authorities have lately drawn attention to an antagonism between malaria and cancer, and that they bear an inverse ratio to one another in their prevalence. These points have brought forth a suggestion that persons be inoculated with malaria to protect them from cancer.

Malaria and cancer might be considered antagonistic to one

another; but it is by no means logical or scientific to conclude that the one would protect a person from the other if inoculated. In the matter of their bearing an inverse ratio to one another in their prevalence, the explanation is to be sought for in the peculiar influence of climate in these respective diseases; also the surroundings, habits, and race peculiarities present, which have doubtless a voice in their production respectively.

The one disease is peculiar to tropical, the other to temperate regions. Disease, like plant and animal life, flourishes in particular regions, either tropical or temperate, where the conditions for the life of the parasitic forms are most favourable and the pabula sufficient and suitable for their life and reproductive changes.

I have no desire to discourage the suggestion made of inoculating man with malarial fever to protect him from cancer, nor to affirm that this method of treatment is injurious or free from benefit. I merely wish to point out, that it is not based on facts and observations from a scientific point of view, but purely empirical and wanting in scientific proof since there are no data present to base such views upon.

In India, it will be observed, wherever malarial fever occurs, there, skin diseases and entozoa will also be found to prevail. The more virulent the type of malaria, the worse the forms of skin disease and entozoa as regards obstinacy to treatment and expulsion from the body.

Regarding the suggestion of malarial inoculation for cancer, it has not been shown that Europeans who suffer from malarial fever are immune against cancer.

XVIII.

Malaria, Cancer and Protozoa.—The analogy between cancer and malaria has been pointed out of late because of their supposed origin from "protozoa" or "parasitic protozoa;" also on account of certain predisposing causes in the soil and the seasonal inundation of rivers which overflow their banks. How far we are justified in drawing the analogy remains to be seen.

The presence of malaria in the tropics which abound with insect life as a vehicle of transmission, has been enunciated and demonstrated; but in the case of cancer in temperate and cold regions, a similar mode of transmission has not yet been shown.

The power of transmission of cancer from host to host, or from animal to animal, or from animal to man, or vice versâ, has not yet been shown to be the actual case. Ballance and Shattock as well as other investigators have failed in their experiments in this direction.

Cancer and malaria are also said to bear an inverse ratio to each other in their prevalence and mortality, so much so, that it has been suggested that persons be inoculated with malaria to render them immune from cancer. Empiricism precedes facts in medical science and treatment, and we cannot therefore altogether decry this proposed method of treatment. But at the same time, if we

for a moment consider the vitally distinct conditions necessary for the growth and development of these diseases respectively, I think we should then see the fallacy of the proposition. Nature moves by laws, and these I maintain hold good in the natural history of diseases of tropical and temperate regions respectively.

Malaria has always been regarded as a dangerous factor when associated with other diseases, such as enteric, &c. Its combination with other diseases demands a particularly careful and systematic treatment in the tropics, so that we might reasonably suppose that its combination with cancer would prove a far graver danger than a cure if we admit the commonly accepted views on the subject by medical observers in the tropics.

The mere fact of cancer not being so common in the tropics as in temperate regions, and also the other points above mentioned which show an analogy to malarial fever in its causation and conditions, would not however justify the conclusion being based on actual facts relating to this disease, for the one, (malarial fever) is a growth of the tropics, the other of temperate regions.

The fact that cancer is found in India and the tropics would not dislodge the statement that it is a growth of temperate regions. India is a large country with many climates and races with peculiar habits, and it is possible for cancer to be imported from a temperate region to a tropical, as malarial fever is from the tropics to temperate countries.

Parasites of the human body select their "habitat" in much the same way as certain insects and butterflies favour certain kinds of vegetation and flowers. Often will it be observed in India, that a particular butterfly will be found in one small patch in a district and nowhere else. Certain orchids too, will grow in groups and be found in small numbers in a country and be seen nowhere else. The soil and nourishment therefore, are the first necessities for the seed to be attracted, and then to germinate and develop. If the conditions present are not favourable, the seed might lie "dormant" or "latent," and develop later.

The human soil is likewise subject to changes by the implantation of certain growths through external and internal causes. The introduction of the seed or germ is the work of chance as a rule, and that seed or germ, might be called a parasite which is either a vegetable or animal organism.

As a rule, the vegetable seems to be almost the first to appear, and then the animal; sometimes the latter comes almost simultaneously with the former through a process of fermentation of the vegetable and the influence of air, moisture and sunshine which are factors necessary for the process of fermentation. If the conditions be suitable, the animal takes the place of the vegetable, whilst the vegetable passes into a "still," followed probably by a "motile" stage, and this goes on year after year, season after season, until the starting point loses its identification. The animal also passes in its various stages from host to host in the bodies of insects, fishes, birds, and animals, and last of all to man; but in this circuitous passage it loses its identity much in the same way as the transformation from the egg to the larva, the

pupa, and last of all the winged insect which can scarcely be recognized then as having started from the egg.

In cancer, we find the highest mortality present among those whose occupation and life offer the greatest temptation or attraction for the alcoholic habit, which, as I have said before in dealing with alcohol as a factor in cancer, creates or prepares the soil. Anything which favours chronic irritation and inflammation through the nervous system with loss of co-ordination in the physiological functions of the human body, destroys the balance between absorption and elimination through a damming up of the excretions from the skin, alimentary canal, lungs and kidneys, as well as the organs of generation. Then is the psychological moment as it were, for foreign bodies, germs and parasites, to set up fermentative action of a lactic acid, butyric, uræmic, mucic or nucleic nature which become powerful and persistent solvents of cells and tissues, as well as irritants and pabula for the germs and parasites of cancer, when they establish themselves and create exuberance of tissues and growths which become malignant through toxic secretions which form, causing autoinfection through the blood and lymphatic system.

This is far more prone to be the case at certain periods of life in man and woman when there is a tendency for the whole system to take up degenerative changes through lessened vitality, sedentary or sluggish habits, morbid cravings and loss of nervous control, all of which conditions are under the nervous system (cerebro-spinal and sympathetic system of nerves). At this period there are alterations in the blood, the cells and tissues, as well as the organs which render the whole body more susceptible to fungoid growths, parasites and putrefactive organisms, to do their active work of upbuilding and nesting. These organs might remain in a latent or dormant condition for long periods awaiting their opportunity; but never lose it when there is the chance.

Boils and carbuncles, for example, are simple enough in certain constitutions which are called healthy, for they attack people who are full-blooded and plethoric, as well as those who are run down and anæmic; but in particular constitutions such as the diabetic they are often a dangerous local manifestation of a general disease.

The treatment of boils and carbuncles differs in people, so that it is not merely the disease, but the patient whom the surgeon has to treat, and unless treated successfully to the end, who knows if the *materies morbi* have been eliminated from the system entirely. These products might accumulate in the blood until some explosive cause brings out the taint, so that there is a local manifestation probably highly malignant, either from a previous constitutional taint or an acquired habit.

We know for a fact, that one boil will often cause a succession of crops if improperly treated, and in a diabetic constitution, will break out all over the body.

In malarial constitutions also, if effervescent wines, such as champagne, which contain much sugar or syrup, are taken in excess in India, boils appear, which, if not treated properly and the *materies morbi* eliminated, lead to hepatic changes and abscess.

In hot climates, such general changes in the blood through

climate and bad habits culminate in pathogenic organisms with suppuration; in temperate climates, with growths of a benign or malignant type without suppuration; or if attended with suppuration, the points are minute and form foci for further changes leading to caseation and growths which might become malignant if the proper conditions be present.

Carbuncles on the other hand, are single and not multiple as a rule, and if unskilfully treated, soon endanger the life of a patient by creating a blood poisoning and rapid destruction of life.

If cancer be regarded in the same light, only chronic in its action, we can well understand that it assumes different forms of malignancy in different constitutions, which condition forms the basis of the growth.

Cancers might be regarded as idiopathic when they appear without any apparent exciting cause, and traumatic when caused by a blow or a knock as an explosive cause which is a shock to the system. Such a view of cancer might be considered absolutely in accordance with the theories and doctrines of medicine and surgery, so far as inflammation and growths can be produced through previous chronic infectious diseases having caused alterations in the system with loss of nervous control. The spread or repetition of cancer might be caused by continuity of tissue sometimes; at other times, by a process of transplantation and metastasis which might lead to metamorphosis of cells.

If cancer bears a resemblance or relation to chronic infectious diseases, then there are also certain important phenomena which bear a resemblance to the changes we witness in inflammation leading to caseation, particularly in certain constitutions such as the tuberculous, scrofulous, and syphilitic. Whether inflammation precedes the chronic infection, or the infection is present in a dormant condition previous to inflammation, it is certain however, that the two are in combination and become manifest as a growth. The malignancy then remains a mystery to solve; this may be due to an inherited or acquired habit or constitution which is at the base of the whole matter.

It seems to me, that if cancer be regarded as similar to chronic infectious diseases, there is probably an incubation period of indefinite length, or a precancerous stage which has not been recognised up to now, or regarding which, no settled opinions have been expressed to enable one to diagnose the complaint with certainty at this particular stage of its existence in the human body. The most settled point with regard to this disease is, that it appears in people at the middle period of life or the "menopause" and after more frequently; and that there is a loss of nervous control attended with strong emotional feelings previous to the local manifestation of cancer.

To those who have lived and been brought up amid the busy hum and din of large European cities, it has perhaps not been observed so acutely as by one who lives away in a tropical country where the conditions of life are attended with less "hurry-scurry" and who then comes to London for a holiday or for rest and change, that there is a growing increase of loss of nervous control and co-ordination of muscular and physiological

action among young people, particularly young girls. This may be noted by the medical observer any day among a group of young people in the train, in the street, or in a crowd. It has never struck me so remarkably before as nearly the last three years I have been in London. There is a larger number of young people who suffer from chorea or St. Vitus's dance than were to be seen before. One sees as many as ten per cent. of such cases in a crowd or in the train. Among adults there are a few cases also to be seen. What is the cause? Not the stress and strain of life experienced immediately by such young folk, surely? No, hereditary nervous weakness transmitted from parent to offspring most probably, with forcing of education in a form which the brain is not fit to receive. Anæmia and chlorosis also are to be seen among young lads and women far more than they were before. These are observations or truths, however unpleasant, I am bound to mention, as they are probably the first seeds of a disease in my opinion, which precede changes through loss of nervous control in later life, which creates growths. Anything which affects the nervous system, lessens the powers of the body generally for meeting the exigencies and strain of life at the middle period. It is at this period that the cares and responsibilities of married life and a family weigh heavily on some, and the body and mind crave for a stimulant; alcohol is sought in excess; excessive smoking and other habits are indulged in to drown dull care, and thus we see premature breakdowns in life and an increase of malignant diseases such as cancer. Dull care sits at the board and poisons the whole system through excessive food and drink, with other bad habits which are cultivated. The long incubation period of cancer which I have referred to, finds support in diseases such as hydrophobia which have an incubation period which is indefinite, or at any rate, astonishingly long before the acute or painful symptoms are manifest. Why? Because of the absence of the explosive cause which sets free the reins of control.

XIX.

The Relation of Mucoid Tissues and Mucus to various Agents and Ferments connected with Nervous Disease and Malignant Growths resulting from loss of Nervous Control.—Mucoid tissues or mucus, and the remnants of such within the healthy body, seem to be one of the factors necessary for the determination of abnormal growths such as cancer at certain periods of life, when there is loss of nervous control, and as the result, lowered vitality generally.

Some explosive or exciting cause sets up inflammatory and other changes which create a peculiar ferment (and probably a toxin or ptomaine also) at certain periods of life, which readily act upon mucus and mucoid tissues and their allied forms, bringing about exuberance of growth, granulations, and an upbuilding which are not healthy, but weak, and subject to degenerative changes terminating in caseation or cheesy degeneration. If these chronic caseous masses, as we are told, are capable of setting

up chronic irritation after a quiescent period, and later on, abnormal growths either at the actual point where present, or, at a distance by transplantation, it is of importance to enquire into their relation to cancer phenomena and growths.

By such abnormal changes there is abnormal secretion or flow, cellular hyperplasia, and overcrowding of cells which bring about degeneration through pressure and loss of nervous control. Further nervous changes occur through starvation of the nervous system, and thus malignancy or putrid decomposition locally which creates the cancerous cachexia and autoinfection later on.

Owing to such changes, there is general lessened vitality and loss of power of elimination through the organs of secretion and excretion whose physiological co-ordination is disturbed or dislocated, and so all the organs suffer and are liable to the same starvation as the nervous system through the vascular, presided over by the nervous; irritants form, while Nature endeavours to eliminate the *materies morbi* through the most easy and rapid passage. In this attempt, the strain is most felt in certain organs, particularly at the middle period of life, hence, we have malignant growths at the points where the strain and physiological functions are most concerned in endeavouring to bring about a healthy and abundant secretion to meet the chemical alterations.

The process of fermentation is a peculiarity of the yeasts, and if a sugary solution be added to "*saccharomyces cerevisiæ*" or yeast plant, and kept at a proper temperature, alcohol and carbonic acid are formed, and the escape of the latter causes a bubbling which is fermentation.

Examples of this fermentation process are seen in bread, in acetic acid fermentation, where alcohol is converted into vinegar, and the active agents are minute bacilli (*mycoderma aceti*, *m. pastorianum*). Lactic acid fermentation, in which the sugar is converted into lactic acid by "*Hueppe's lactic acid bacillus*." Butyric fermentation follows upon lactic acid in milk, butter, cheese. The butyric ferment is known as "*bacillus butyricus*," and from the occurrence of spore formation, as "*clostridium butyricum*."

Ammoniacal decomposition of urine is also due to a ferment known as "*micrococcus ureæ*" where the urea is converted into carbonate of ammonium.

Beer, too, is a product of fermentation.

The nucleo-proteids are compounds of proteids with nuclein; they are found in nuclei and protoplasm of cells. Caseinogen and vitelline of egg-yolk are similar substances. If butyric acid, which is found in sour perspiration, is found to be caused by the ferment known as "*bacillus butyricus*," then "*nucleic acid*," which is the product formed by the decomposition of "*nuclein*," together with a variable amount of proteid, yielding phosphoric acid and various bases to meet a demand in the animal economy, must be also due to a highly organized ferment with certain bacilli, to which the term *bacillus nucleicus* might be rightly applied. This latter acid is probably necessary for its action on certain carbohydrates called animal gum, which cause a decomposition leading to fermentation in a second stage, which produces a heaping up and the formation

of nests into which if certain parasitic or fungoid growths or "protomyxomyces" enter, a rapid growth is established which is subject to degeneration.

Inversion by yeast is also another term used for the same process above mentioned in relation to lactose and the lactic acid bacillus.

The growth is an upbuilding process formed from a glycoproteid, which is a stage in the upbuilding of the carbohydrate named into the protoplasmic molecule.

We find an analogy in the nodules formed in certain "leguminosæ," which are described. Reference must be made here to the important discovery made in 1886, where the nodules found at the roots of many leguminosæ are due to certain soil bacteria found, which were peculiar to each kind of plant. These have a remarkable capacity, we are told by Curtis, for fixing nitrogen from the air. Once parasitic in the root, they give rise to these nodules (the formation of oak galls), and then multiply rapidly. The contents of these nodules become absorbed, with apparent inversion of the plant cell by the bacteria. That the associated rapid growth of the plant is not accidental has been proved experimentally by means of culture.

In the human body, I maintain that the different forms of mucin and mucoid tissues are capable of forming into nests for the setting up of new growths and cancerous formations in the presence of carbohydrates and animal gum, with the help of vegetable and animal organisms, which create fermentations and acids, and so fix the nitrogenous element necessary from the air and the nuclei of cells.

Fungi are found in various conditions in the bodies of insects, animals and man. The "*Botrytis bassiana*" in the silkworm causes "muscardine," a disease which kills and infects the progeny of these insects as Pasteur's experiments have proved. In the West Indies, it is not uncommon to see certain species of polistes carrying about in their bodies, "plants," the germs of which have probably been introduced through the breathing spores, which spread and destroy the insect. After death, the decomposing tissue of the body is still more adapted than the living structure, as nourishment or pabulum.

The "enterobryus" is another instance of an entophytic fungus found in the stomach of certain species of "*Julus*," which consists of a single tubular cell.

It is not a little interesting that the entozoa infesting the alimentary canal of some animals are clothed externally with an abundant growth of enterobryus.

All these fungi act as ferments in certain conditions of the system, preceding the appearance of the animal parasite or "protomyxomyces" if the conditions are suitable.

Sanfelice, Roncali, and Durante also I believe, regard the "parasitic protozoa" of Metchnikoff as "blastomycetes," which are a variety of "saccharomycetes," and the latter, according to De Bary and others, are nothing but the developmental stage of fungi, which belong to the "phyco-," "asco-," or "basidiomycetes" which are mould fungi or "hyphomycetes."

Yeasts or fungi belong to the order "saccharomycetes," *i.e.*, they

are unable to invade living tissues of a healthy organism whether animal or vegetable, with the exception of the organism of "thrush" a disease of infants due to the "oidium albicans" ("saccharomyces albicans"), a point worthy of note with reference to the development of cancer, since this organism has been found in certain chronic infectious diseases (phthisis, typhoid fever and cancer) deposited on the fur of the tongue, and its relation to these diseases is interesting.

"Saccharomyces albicans" (oidium lactis), or the fungus of "thrush," we are informed by Dr. H. Curtis of University College Hospital, London, is associated with the formation of circular patches of a milk-white colour on the tongue and mucous membrane of the mouth. These patches are not a single yeast, but a mixture of yeasts, moulds and bacteria with epithelium, according to Crookshank. It has been found in various situations in the pharynx, œsophagus, furred tongue, and diphtheritic membranes.

An active state of the buccal mucous membrane and buccal secretions seems necessary for the active growth of the fungus, and owing to the excessive amount of mucus which readily forms acids in infants' mouths, is attributed the frequency of the disease known as "thrush" in young infants as compared with older children, according to Fagge. We are also informed by the same authority, that it occurs in adults suffering from extreme exhaustion after a prolonged illness—typhoid fever, phthisis, and cancer.

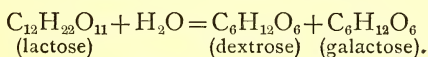
These are points of great importance to bear in mind with regard to cancer in its relation to chronic infectious diseases and irritation, and in dealing with ferments and parasites which are present as precancerous conditions leading to cancer in the human body.

"Microsporon furfur" the organism of "pityriasis" or "Tinea versicolor" (chloasma), is probably also identical with "oidium lactis" (thrush). More recently, however, the fungus of "thrush" has been termed "saccharomyces mycoderma."

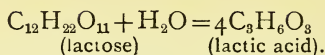
The "saccharomycetes" and "hyphomycetes" are related to one another. In the former, the growth is made up of round or oval cells and there is no true mycelium.

Moulds are characterized by the presence of branching filaments or "hyphæ" interlacing to form a network or "mycelium," like retiform tissue of the connective tissue type.

With regard to the formation of acids in infants' mouths through the excessive amount of mucus according to Fagge, it is interesting to note the changes which lactose or milk-sugar undergoes in the process of digestion and formation of lactic acid. Lactose is described as occurring in the urine of women in the early days of lactation and after weaning. It is much less soluble in water than cane-sugar or dextrose, and it can be hydrolyzed like cane-sugar in the dilute mineral acids or inverting ferments, when it takes up water and dextrose and galactose are formed. With yeast it is first inverted and then alcohol is formed *slowly*:

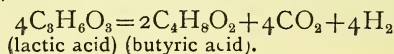


With lactic acid organisms ("Hueppe's lactic acid bacillus") lactic acid fermentation is produced:



This may also occur as the result of putrefactive bacteria in the alimentary canal.

The lactic acid fermentation is followed by butyric acid (*Clostridium butyricum*) fermentation due to the "*Bacillus butyricus*."



Galactose, which is one of the glucoses formed when lactic acid is hydrolyzed, yields "*mucic acid*" ($\text{C}_6\text{H}_{10}\text{O}_8$) when oxidized by means of nitric acid, and is only sparingly soluble in water.

Dextrose, which is the other glucose formed, when treated similarly, yields an isomeric acid, known as "*saccharic acid*," with the same empirical formula as mucic acid, but readily soluble in water.

Butyric acid, which follows lactic acid fermentation, is the result of a bacillus, and is an irritant which favours fungoid growths on the skin, and must do so in the mucous membranes internally, and so must "*mucic*" and "*saccharic*" acids respectively, when formed from galactose and dextrose.

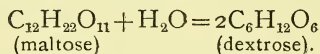
Butyric acid is also derived from fatty acids. The proteids occur in animal and vegetable organisms, and none of the phenomena of life occur without their presence.

Proteids are highly complex compounds of carbon, hydrogen, oxygen, nitrogen and sulphur, occurring in a solid viscous condition, or in solution, in nearly all parts of the body. Carbohydrates (glycogen) and fats may also originate from proteids; but carbonic acid, water, and urea, are the chief final products.

In cancerous growths there is probably a conjugation between a body of the composition of "*glucosamine*" and proteid. Glucosamine may be derived from the chitinous shells of crustacea (water fleas, &c.) with hydrochloric acid. It is formed from a molecule of grape sugar (dextrose) or other hexose, by the replacement of an OH group by NH_2 . In chitin this substance occurs with acetic acid or some derivative of acetic acid. A somewhat similar substance is found in the cartilage of vertebrates; the cartilage matrix containing "*chondro-mucoid*" and "*chondrin*." These derivatives are capable, in the presence of ferments created in the body through the humblest plant and animal life, of causing various growths which might assume a malignant or cancerous character through further decomposition setting in.

In connection with the subject of the above changes in lactose and lactic acid fermentation, certain diseases attacking wines and the organisms they create are worthy of study.

Malt liquors and maltose are worthy of study also. Maltose is the chief end product of malt diastase or starch. It is also the chief sugar formed from starch by the diastatic ferments contained in the saliva (ptyalin) and pancreatic juice (amyllopsin). By prolonged boiling with dilute mineral acids or by means of an inverting ferment, such as occurs in intestinal juice, it is converted into dextrose:



It undergoes alcoholic fermentation readily.

The diseases of wines are produced by certain saccharomycetes and hyphomycetes, cocci and bacilli, and it is important to bear these in mind when considering the process of digestion and the effects of indigestion in the alimentary tract in conjunction with carbohydrates, animal starch, and the different proteids.

Ropiness or viscosity in wine is due to small "cocci," while bitterness in certain brands of red wines is due to "bacilli."

We cannot afford to neglect these points in the consideration of various changes occurring in the body previous to cancer growths and precancerous conditions, since such are the necessary factors created in the tissues of the human frame which is the soil for cancer. In the same manner as certain virgin soils are suitable for particular vegetable growths and unsuitable for others, and have to undergo a peculiar preparation before they become suitable, so is it with the soils for cancerous growths, they must undergo a preparation—it may be for years—unless some intercurrent disease of a chronic infectious type renders it suitable much sooner than would otherwise be the case, and it is these conditions which might be called, precancerous conditions. The precancerous conditions are not to be limited to a particular disease process of a certain region of the body such as the skin. We have to consider a far wider basis which is preparing the system in which the blood and the nervous system are two of the most important in the body, for the one carries the oxygen and the various elements and constituents for selection by the organs which secrete and excrete, and lays the foundation of a sound or an unsound constitution, "for the blood is the life"; the other, (the nervous system) presides over the circulation and other functions, and without it, and its secret mode of work which we can scarcely appreciate when the digestion is proceeding, we cannot have the pulsations of the heart and the circulation of blood from the pumping action, nor the respiratory action of the lungs and movements of the various alimentary organs, which are also connected with the sympathetic system. If we now consider that although these are all dependent on the nervous system (brain, spinal cord, and sympathetic system of nerves and ganglion), what is the brain dependent on? Why, on the process of digestion and elaboration and the carriage of the elements of nutrition and oxygen, for the blood is the life, and the life of the individual and his brain are dependent on what is elaborated day by day in the system. Our food and drink and chemical physiology, therefore, are of importance, as the materials elaborated for the building up of the human frame, and for this food we are dependent on the vegetable and animal world. So that Dr. James Henry Bennett was not wrong in drawing the simile he did for us, and which I have described before in the previous pages. "Change, constant change, is therefore the law of organic life. The molecular elements of the tissues of which the animal economy is composed are constantly dying, being resolved into their chemical elements, and are as constantly renewed. This renovation, this repair, takes place principally, as well as the original formation, out of the nitrogenous elements of the blood, the albumen and fibrin." It is the final destination of these which has to be considered in the up-

building of the human frame and the elimination of the "materies morbi" through the lymphatic system and the organs of excretion, including the skin.

Food and drink, healthy functions and habits in life, in this constant change which is the law of organic life, is very necessary to consider for the individual, the family, the race, the nation and its constitution. If you give the organs bad materials and expect them to elaborate good substance or elements out of them for the upbuilding of your body, you expect far greater possibilities than were expected of them by the Creator. It is for you to choose; but if you leave others to choose who do not know your wants so well, or you leave it to chance, you establish conditions favourable for the entry of disease germs and parasites which build out of these bad materials a solid structure for their own existence and the preservation of these lowest forms of life. The elements found in the human body are carbon, hydrogen, nitrogen, oxygen, sulphur, phosphorus, fluorine, chlorine, iodine, silicon, sodium, potassium, lithium, magnesium, iron, and occasionally manganese, copper and lead.

Of these, oxygen (to a small extent) and nitrogen are found dissolved in the blood-plasma, hydrogen is formed by putrefaction in the alimentary canal. Curtis tells us that "with some few exceptions such as these, the elements enumerated above are found combined with one another to form compounds." These compounds or "*proximate principles*" are (1) mineral or inorganic; (2) organic compounds or compounds of carbon. The *inorganic* are water, various acids (HCl in the gastric juice), ammonia (in the urine), and several salts, *i.e.*, calcium phosphate in bone, sodium chloride in blood and urine, and others. The *organic* are various groups of alcohol and *organic* acids and their derivatives (fats and carbohydrates); various derivatives of ammonia, amides, amines, urea, &c.; aromatic bodies, or derivatives of benzene; proteids, the most important of all, and substances allied to proteids, *viz* :—the albuminoids, ferments, and pigments.

All these substances exist in certain healthy proportions in the healthy individual, and any departure from this proportion is influenced by change of surroundings and habits, in which food, drink and exercise have a great voice in either disturbing, balancing, or restoring when there is a loss; or, if there be a heaping up or over-stimulation through abundant formation, the excretory functions are called into play, which leads to putrefactive decomposition and malignant changes if they fail; so that "*change, constant change*" means, the laws which maintain the balance in the system through co-ordinate action in the secretory and excretory organs and their functions. "The A B C of chemical physiology" is, as we are further told by Curtis, the subdivision of organic substances into proteids, fats, and carbohydrates. These are the foundations for all fermentation and active change by chemical transformations or splitting up, in which the most important inorganic substances at work are *water* and *salts*. These points have to be constantly borne in mind in the processes of chemical physiology. The water which is necessary is for the carriage of the necessary chemical constituents to the parts and organs which

select their materials through their cells by osmosis, endosmosis and elaboration for healthy physiological functions, in which the salts are substances to maintain purity or neutrality, and urea, *neutralizing power* thereby for the preventing of undue acidity, or activity on the part of germs leading to fermentation and coagulation, or an alkalinity for the rapid flow or carriage from the system of morbid materials when they accumulate. They might be described as the balancing powers which are capable of creating good or evil forces according to their proportion in the blood and tissues of the body.

Then again, there is a system of organs present in the human body as a *corrigent* (to use a term in the art of prescribing), which endeavours to come to the rescue to meet the evil influences of secretions and excretions when they are established, and these, are certain glands in the human body, known as "*ductless glands*" which are *filters* of the system, and which *either drain* the system of impurities by a filtering process, or *throw out* substances into the blood stream, but which have only recently been discovered as having a great influence in the human economy, in possessing functions related to the general metabolic phenomena of the body which are disturbed by removal or disease of the gland. This is an illustration, Curtis tells us, of a universal truth, viz., that each part of the body does not merely do its "*own special work*," but is "*concerned in the great cycle of changes*," which is known as "*general metabolism*." Interference with any organ deranges its function, and through it, causes a dislocation of all throughout the body generally. Removal of the testes not only creates impotence, but alters the growth and appearance of the animal. The changes in the ovaries of the female, are reflected to the breast and the uterus, which are in sympathy through the nervous and sympathetic system, by creating peculiar *ferments* which produce new growths if suitable and favourable conditions, both external and internal, are present in the individual.

One of the glands of this description which needs consideration in connection with cancer, is the thyroid gland. There seems to be a strange compensatory and a correcting influence, which this gland has in the human body. Its atrophy leads to "*myxœdema*;" its hypertrophy is the condition known as "*goitre*" or "*exophthalmic goitre*," which leads to a form of idiocy known as "*cretinism*." Myxœdema was originally described by Sir W. Gull as a *cretinoid* condition attended with a form of dropsy (which is a symptom and not a disease, and is due to loss of balance between absorption and elimination), in which the fluid is of a jelly-like consistence (resembling cystic or ovarian fluid).

Goitre is an endemic disease which occurs in certain districts, and particularly at the base of high mountains. The mass of evidence as to its causation, goes to prove distinctly that it is due to impregnation of drinking water with *excess of lime and magnesia salts*, these salts being dissolved in the water, while it percolates through geological strata containing them. This disease is more frequent in *females* than in *males*. I have seen it present in the Sub-Himalayan tracts in animals (dogs), in India.

The districts where the lowest mortality from cancer prevails,

are districts with *chalk* and *limestone* formations. Whether the creation of goitre in districts whose waters abound in lime, leads to *myxædema* through a "*cretinoid*" condition being induced, followed by atrophy or fibroid degeneration of the gland, is one which seems to demand attention in its probable relation also to cancer (which is attended with certain loss of mental balance and control), since thyroid extract which contains *iodo-thyrine* and *thyroid antitoxin*, and is used for the treatment of *goitre* and also for *myxædema*, has lately been extolled as a *remedy for cancer*.

The diseases above named, seem certainly to bear curious relations to each other owing to this therapeutic influence of thyroid extract upon each of them, as well as for the reasons mentioned before with regard to the influence of sex and geological position.

Thyroid antitoxin is not albuminoid, but "probably a derivative of '*guanidine*'" as Ringer tells us. Its therapeutic value, he further informs us, "*is not established*." In pages 660 and 661, he mentions this drug and its uses, and he states, that it has proved useful in the treatment of obesity, and in certain skin diseases with some success, viz., "*pityriasis rubra*," "*ichthyosis*," "*lupus*," "*eczema*," and in some cases of "*psoriasis*." Such obesity and skin affections might be precancerous changes. He warns us, however, of its uncertain and unstable results, and the depression it creates in large doses.

As in the diseases above mentioned, and in certain skin diseases, females suffer more than males, this also is found to be the case in cancer. Females suffer most on account of the *uterus* and *mammary glands* being attacked; whilst in males, it is the *digestive organs*, *bones* and *skin*, which are most affected. A strong inference, or I should say presumptive evidence, is here produced from these facts, that in females the forms of cancer present are induced through the influence of the nervous and sympathetic system on the *mammary glands*, *uterus* and *ovaries* by a reflex act at the "*menopause*" chiefly, through atrophy and degeneration of the ovaries, when there is a general metabolic alteration created, which might affect the thyroid gland; and the decaying or dead ova present, might, during this change—instead of being carried away from the system in the menstrual fluid—*infect the system*, whilst their influence becomes transplanted or transported as a ferment to those portions of the female which are in strong sympathy with the ovaries, and act as a ferment on the mammary gland and uterus, which is capable of setting up a new growth in the presence of other favourable conditions that exist, in the same manner almost as fleshy growths occur in mole pregnancy of the uterus.*

But in the case of males, the *digestive organs*, the *bones* and *skin*, are most affected, since these are the parts most exposed to strain and attack because of the peculiar conditions of life in man in his occupation as compared with woman, viz.:—the effects of inclemency of weather, manual labour, free perspiration (butyric fermentation), the alcoholic habit with smoking, together with habits and occupations in life which cause dust, dirt and soot to clog the skin, and at the junctions of skin and mucous membranes,

* Read the "Signs and Symptoms of Pregnancy" (Playfair, vol. i.).

where peculiar ferments also form of the butyric acid type which act as *irritants* and *solvents*. These bring about a change in the general metabolism, by a gradual loss of function or decay of the particular organs, which change is reflected through the nervous system and acts as a ferment in the presence of other favourable conditions which are capable of setting up new growths, either of a traumatic or idiopathic origin, *i.e.*, through external or internal causes respectively.

We cannot, however, get away from the fact that "*leucocythæmia*" of various kinds, and the causation of this disease, whether *splenic* or *lymphatic*, seem to have some strong influence in determining the particular locality and form of cancer. Little can be said, we are told by Dr. Frederick T. Roberts of University College Hospital, definitely as to the causation of leucocythæmia. It has been regarded as the result of a "special diathesis." Dr. Gowers found that in *one-fourth* of the cases which he analysed, there was a history either of ague or residence in an ague district. The interval between the malarial affection and the development of the disease varied from a few months to thirty years. Is it not possible that in such cases where the patient has lived for a long period in an ague district, or a district thickly wooded with plenty of impure water around, there are conditions suitable in "cancer fields" for the development of this *peculiar diathesis* which creates also a form of disorder *akin to ague* or malarial fever in a suppressed form at certain favourable periods and seasons which become manifest as cancer at the middle period of life? The conditions for this local manifestation are present either in the form of a ferment or an external injury, bite of an insect, or even a sudden jar of a bone or joint, which excites or brings out the cancerous taint or sets up precancerous formations; hence we see *rodent cancer*, which is the least malignant of all when the exciting cause is in the *skin*, only through irritation—the bite of an insect; *epithelioma*, when at the *junction of skin* and *mucous membrane*; *columnar or cylindrical epithelioma* and *glandular cancer* when there is an alteration in the saliva, gastric and intestinal secretions (including the pancreas) of a fermentative character with those other conditions already mentioned, which first lead to *dyspepsia* and its results throughout the intestinal tract (the same as "thrush" can be also produced in children); *osteoid*, when *bone* is affected through changes in the *bone marrow*, &c. All these changes are coincident with "*leucocythæmia*" which is *due to a special diathesis*. It need not be of a purely malarial origin; but akin to that condition in a temperate climate under the local conditions of a "cancer field" or an ague district, in both of which water and thick forest or woods play a great part in originating conditions favourable to this peculiar diathesis in the same way as there is the malarial diathesis in the tropics. The blood of patients living in such districts, and of those suffering from "leucocythæmia" is worthy of careful microscopic examination and differentiation, as well as the changes resulting in *healthy persons* who freshly migrate to such districts and contract one or other form of leucocythæmia, for, as mentioned previously in these pages, the "*primitive bodies*" of Plehn are noticed in West Africa in Europeans freshly arrived, and in non-malarial and malarial

blood also. In the former case, always followed by malarial fever. There *must be*, therefore, "*primitive bodies*" of a like character in those freshly exposed to the influences of a "cancer field" or district, and of leucocythæmia in an ague district in temperate regions. It seems to me, however, that the *splenic* and *lymphatic* forms of leucocythæmia are two *distinct* conditions, *i.e.*, the one, arising from a purely mild though chronic malarial influence through residence in a fen or ague district; the other, in a "*cancer field*," where the soil is contaminated in a *peculiar way* by cancer mortality and causes a peculiar diathesis which may be acquired. In malaria of the Tropics, the different forms of malaria are diagnosable by peculiarity in forms of the "malarial plasmodium." In leucocythæmia it is also possible that there are *distinct* forms present which indicate a *malarial* or a *cancerous* origin respectively, probably due to a distinct mode of infection through a parasite as distinct in its peculiarities of structure as the Anopheles malarial-bearing mosquito is from the culex or other forms of the Anopheles tribe. In cancer, however, we might possibly have a distinct "*simulida*" or sandfly, or an internal parasite created in the intestine, which produces, either a dermoid cancer change of a comparatively mild character, such as *rodent cancer*, which protects the individual from the severer types by a suitable inoculation of a healthy individual recently arrived in a "cancer field" from the blood of an infected leucocythæmic individual (in a similar manner, as Delhi or Oriental sore is found on the skin in the Tropics, and is said to protect an individual from malarial fever). Usually it is the individual recently arrived in a malarial district where sandflies (*simulidæ*) are found, that is subject to such attacks and suffers from such sores if the conditions be favourable, (external as well as internal) or a more virulent form. Cancer, where the distinct germ or parasite might be ingested, inhaled, or inoculated, and it depends very much upon the condition of the individual and his surroundings at the time, whether predisposed by having "*primitive bodies*" of leucocythæmia only, or a pronounced leucocythæmia, previous to this latter manifestation of cancer. As to the particular manifestation, the length or period of exposure to the local and geographical conditions previous to *accidental inoculation*, together with the conditions of all the organs and their functions, would greatly influence the particular form or manifestation of cancerous growths which might break out in an individual.

The pathology of leucocythæmia has been much disputed, we are told. It has been regarded as a primary disease of the blood attended with the formation of *excess of white blood corpuscles*. The primary changes are supposed to occur in the spleen. The marrow of bones and the lymphatic glands and structures have also a voice in the production of this excess of white blood corpuscles. According to the location of this lymphatic leucocythæmia, *i.e.*, in the mesenteric, the brachial, or the cervical glands, so the influence they exert in determining the local manifestation of cancer in the early stage of this leucocythæmic condition, when the capillaries become distended with leucocytes and there is a lymphoid

or adenoid change accompanying the same around the infected region or locality.

It is important therefore, to note the changes in the blood and lymphatics of persons exposed in "cancer fields" to this peculiar diathesis described as a form of ague or malaria; but most probably a *distinct* form is present in cancerous cases in "cancer fields"; very likely it is the *lymphoid or adenoid form* of this disease.

It will be noticed that the specific gravity of the blood in leucocythæmia is much lowered, owing to *an increase in water*, the average being 1042. The *hygrometric* conditions of the atmosphere in cancerous districts where water and woods abound, would probably check or hinder evaporation through the skin, hence the peculiar condition of a lowered specific gravity. According to Havilland limestone and chalk absorb water, and so one of the factors in cancer is taken away. The white corpuscles we are also told, are *either of natural size*, or some of them *considerably enlarged*; they appear *granular*, but on addition of water *swell up* and exhibit from *one to four nuclei*, some of them having undergone *fatty* degeneration. Nucleated red corpuscles are also described, and are regarded as *intermediate elements* between white and red corpuscles. Cornil and Ranvier have described *very small spherical granules* of an *amber-yellow colour grouped round the nuclei* of many of the *largest* white corpuscles, due it is said to *destruction* of the *red corpuscles* and *absorption* of the *particles* by the *white corpuscles*.*

* The various figures depicted in Plate I. and II. by Plimmer are clearly stages in the life-history of the parasite of cancer which find their analogy in those changes to be observed in the life-history of "*Protococcus pluvialis*" and "*Hæmatococcus sanguineus*" on the one hand, and the stages in the infusoria and hæmatozoa on the other. In their relation to one another there are certain biological and biochemical changes which occur, which are difficult to unravel at first, unless it is recognized that the vegetable and the animal in combination create that form of life which is a "*mycetozoon*" or "*protomyxomyces*." We can recognize the difficulty if we consider the encysting process in "*Vorticella microstoma*" and the metamorphosis of "*Trichoda lynceus*" as described by Carpenter.

The hæmatozoa bear a biological relation to the latter (*Trichoda lynceus*) in their metamorphosis, especially if we consider the changes which occur in the larva (*Oxytricha*) in their different stages when eventually an animalcule forms which is very different from that in which it originated. This latter form is the "*Aspidisca*" (Prof. Ehrenberg) which is very much smaller than the larva. How the "*Aspidisca*" form in its turn gives origin to the *Oxytricha* has not yet been fathomed. A sexual process intervenes somewhere, we are told.

If difficulty be experienced in this particular form of life in which the metamorphosis, though recognized as a fact, is hard to unravel in the various stages, there is not the least doubt that the various stages in the "*Mycetozoa*" or "*Protomyxomyces*" have some clue to their development in cancer, if we recognize those stages we are acquainted with in the humblest plant and animal life, which have a strong bearing on the developmental stages of "*Mycetozoa*" or "*Protomyxomyces*."

Darier first described bodies like cysts, with spores, in Paget's disease of the nipples. Wickham found similar structures and figured them.

The "*Mycetozoa*" or "*Protomyxomyces*," like the fungi, have their dried cysts or germs floating about in the air, the soil, and water ready to develop in a suitable host where appropriate conditions are presented; and all our knowledge of their history, as well as the strong analogy of the fungi, seem further to justify the belief that the same germs may develop into several different forms according to the nature of the liquid in which they are by chance deposited. On entering the human body, they excite changes in the metabolism of the system which set

The disposition of the white corpuscles into four, as well as the Cornil and Ranvier grouping described, are to be seen in Plate I. (fig. 6), and Plate II. (figs. 9 and 10), given by Mr. Plimmer, and described in pp. 430-455 of the Cancer No. of the "Practitioner" (April, 1899), which he cannot quite explain as peculiar in biological relation to any parasitic formation and the changes mentioned. These cultures of Plimmer's were made in the following medium for the *isolation of the organisms*, he tells us, on page 350 of the "Practitioner":—"An infusion was made from cancer, just as the ordinary beef infusion is made, to which was added, after careful neutralization, 2 per cent. of glucose and 1 per cent. of tartaric acid. Into this, very small pieces of the growth, cut out with all possible precautions against contamination, were placed under anaërobic conditions, the air being exhausted and hydrogen substituted for it."

Mr. Plimmer describes on page 441 his description of the biological position of the parasite of cancer, which corresponds with those he cultivated by the method described above.

The description given and the character of the parasite of cancer correspond with those changes noticed in "leucocythæmia" and that condition known as "*pseudo-leukæmia*." The one seems in a manner connected with the other, but as I said before, the "leucocythæmia" of an ague district, though resembling in many respects, yet seems to differ from that, in the "*cancer fields*" producing those conditions leading to cancer, which might be truly described as "precancerous changes" and a distinct form of leucocythæmia.

Similar changes corresponding to the above in "leucocythæmia" and "*pseudo-leukæmia*," and those described by Plimmer in cancer tissue and the cultures described, undoubtedly occur as the result of those chemical changes I have already described in pages 39-43, showing the stages in the process from the formation of acids and ferments created in diseased and healthy conditions respectively in man, which lead to certain actions on carbohydrates (glycogen) and fats, and may also originate from proteids in which carbonic acid, water and urea are the chief final products; but in unhealthy conditions, the balance being disturbed, there is probably a *conjugation* between a body of the composition of glucosamine and a proteid, and these are points I have further entered into fully.

Dr. Pavy, in his doctrine regarding "*Myxædema*," has stated

free organic acids or ferments, producing further changes which pass through various stages that possibly might take years to develop into the form of a new growth such as cancer; and it is owing to this great lapse of time that the starting point and intermediate stages seem to be lost. Each separate stage seems to create as it were new symptoms and diseased conditions in the individual, but they all tend towards the new growths, which assume a malignant character by the chance introduction of germs of decomposition. There is not a stage in the biological relation of the parasitic forms depicted in the figures given in the Plates I. and II. by Plimmer which have not their explanation in those humblest forms of plant and animal life mentioned, as well as the disease processes created by such forms in tropical as well as in temperate regions respectively, and which processes, require careful following stage by stage under the microscope lest we lose one single link of the whole chain. It is these which I have endeavoured to point out as bearing a very strong relation to lymphadenoma and cancer after passing through a peculiar leucocythæmia and leukæmia.

that "the condition may be due to an *imperfect performance of proteid cleavage and liberation of fat*, owing to a want of a deficiency of the proper ferment for splitting off fat from proteid." This doctrine might also rightly be applied to cancerous formations, due to a different ferment or organic acid.

We cannot, therefore, under such circumstances as are connected with cancer formation and the precancerous changes, afford to neglect the consideration of the characters in the blood of leucocythæmia cases in "cancer fields," which are doubtless the "*primitive*" conditions or "*bodies*" of cancer which create cancerous formations by certain processes in which vegetable and animal organisms present in the human body give rise to those *unhealthy changes* later, which are reflected through the nervous system by a peculiar ferment formed in cell nuclei and those of nerve cells under suitable conditions, which produce new growths of a malignant character by badly or imperfectly elaborated lymph derived from unhealthy food products in the presence of leucocythæmic blood and peculiar ferments and organisms. The process, though complex in a very high degree, is suggestive of bad sanitary and unhygienic conditions and improper food leading to blood changes and ferments which set up a condition favourable to the chemico-physiological and bacteriological development of cancer, in which the precancerous changes attended with parasitic diseases of the skin and alimentary tract, are essential for the upbuilding of new growths which then assume a malignant character and give out foul odours through putrefactive decomposition setting in—the work of chance and of organisms—and is probably the elaboration of months or years in some cases before the final stages are reached prior to which, there is a peculiar diathesis which might be called *cancerous leucocythæmia*.

In such an elaborate process as above mentioned, it is almost impossible to avoid the repetition of facts which lead to those chemical decompositions and changes giving rise to new growths which I have described, and which seem to be a most wonderful process of Nature which evades detection under the microscope because of the powers of fusion which the organisms possess with the natural cells and membranes of the part; but in this fusion they produce ferments and co-ordinate with those altered unhealthy functions created in the organs, by bringing about a *peculiar diathesis* followed by a growth such as cancer.

Leucocythæmia in a predisposed malarial constitution seems to be more of the splenic than of the lymphatic type, but the latter type (the lymphatic or adenoid), seems to be a precancerous condition in the "cancer fields" which have a tendency to encourage new growths and cancerous formations. As in malarial fever there are in the blood of "*non-malarial*" Europeans newly arrived in West Africa before malaria pronounces itself, "*primitive bodies*," so, in leucocythæmia of the two types mentioned, the changes in the white and red corpuscles might be regarded as "*precancerous primitive bodies*" for reasons already mentioned.

The study of the disposition of the lymphatic glands, the lymphatic and lacteal vessels in the human system is very necessary. These glands are said to cause a filtering of the morbid materials,

so that in the matter of elaboration of chyle, the bad materials must be arrested here and undergo changes in which the lymphoid cells, the hæmatoblasts and the white corpuscles share, and from such foci they distribute their influence locally. In the small intestine, (mesenteric glands) where there are hundreds of these lymphatic glands which are largest and most numerous above, near the duodenum, and below and opposite the termination of the ileum, in the colon, they become enlarged and infiltrated with deposit in fever cases accompanied with ulceration. Their enlargement in leucocythæmia in "cancer fields" is one of great significance. These changes already referred to in connection with the white corpuscles and the forms they assume, which resemble the biological characters of the cancer parasite or germ described and cultivated by Plimmer in his medium mentioned, no doubt are characters which might be described as the "*primitive bodies*" or *precancerous blood changes* in "cancer fields" prior to the origin of cancer growths. In leucocythæmia of the type due to residence in ague districts simply, there might be changes resembling cancerous growths, but not so highly malignant, viz., *lymphadenoma* and the diathesis named "*lymphadenosis*," which is generally chronic and progressive, occasionally acute, and attended with high fever, profuse perspiration, vomiting purging, and mental wandering.

It seems to me, that animals are liable to an infection of a similar character when the lymphatic glands become affected. The consumption of such glands from animals (in animal food) reared in "cancer fields" is capable of creating changes which lead to cancerous growths. Bites from insects which have already attacked such individuals inoculate the *materies morbi* into a healthy and newly arrived individual in such a district, which might take years to develop, awaiting a suitable opportunity at the "menopause" or middle period when cancerous changes occur; but previous to the new growths forming, there is a "leucocythæmia," which is a preparation of the soil. Then, when there is loss of nervous control and a lessened vitality generally, and the conditions are most favourable at the menopause or middle period of life, cancer develops.

If we consider the subject of blood changes and morbid alterations described by Drs. Roberts and Allchin in their works on medicine, particularly in connection with *leucocythæmia* and *leukæmia*, there are points of interest in their relation to *chyluria*, *hæmaturia*, and *parasites*, which infest particular regions of the body in different hosts at different stages of their life history, and which find their way either *actively* or *passively* to certain regions of the animal and human body in their life-history (*gastrus equi* to the intestines of the horse; *Distomum hæmatobium* to the portal, pelvic, and renal veins; *Filaris sanguinis hominis* or *F. Bancrofti*, chiefly in the lymphatic channels).

The life-history of the "*Filaria*" in connection with such diseases as *chyluria* and *elephantiasis* are interesting at this point, as well as the life-history of "*Bilharzia hæmatobium*." According to Sonsino the intermediate host of the latter parasite is a small fresh-water *crustacean* (amphypoda) as described by Notter and Firth on p. 619 of their work on the "Theory and Practice of Hygiene."

The life-history of the filaria-like nematodes, (*Mermis* and *Gordius aquaticus*) to which is due the appearance of "*worm rain*," according to Leuckart, could only be explained by supposing that these creatures had left the bodies of *insects* or *snails* upon which they are parasitic for the purpose of laying their eggs in damp earth.

The "*mermithidæ*" were found not only in the bodies of insects and insect larvæ, but wandering away. The *gordius* was also discovered sometimes as parasitic. At the time of migration the "*gordiaceæ*" are mature, but copulation and oviposition takes place subsequently in water in the case of *gordius*, and in damp earth in the case of *mermis*.

The development of the embryo was traced within the egg during winter, and it was proved that the young larvæ hatched in spring, make their way into the interior of *young caterpillars** just out of egg.

Whether the embryo of *gordiaceæ* and *mermithidæ* be conveyed passively or actively, it finds its way into the body of the host, and becomes, in the interior of the infected animal (sometimes even in the intestine, *e.g.*, *gastrus equi*), a parasite which may be compared to the second developmental stage of a helminth. The parasite remains quiescent for a time, which it spends in growth and preparation for its future metamorphosis. At the end of this period it instinctively begins to travel, and leaves its place, either by the natural passages ("the gadfly of the horse, for instance, through the anus, that of the sheep through the nasal cavities"), or if this be impossible, by boring through the tissues; the parasite thus arrives at sexual maturity at large, and often differs markedly in form from the preceding larval stage. This wandering often causes the death of the host.

The life-history of the *gordius* is more complicated, inasmuch as it passes into a second host before commencing its metamorphosis. This is not peculiar, we are told by Leuckart, to *gordius* alone, but occurs in the case of certain other *nematodes*.

The larvæ of the *gordius* and several species of *distomum* and *bothriocephalus*, are provided with a special boring apparatus. The difficulties of boring are not very great, provided the right host is met, *e.g.*, larval insects,† crustacea mollusca and so forth,

* "*Empusca radicans*" and "*Tarichium megaspermum*" like "*Empusca muscæ*" (in the fly causing its death) are found in the transparent skin of the caterpillar of the cabbage-white butterfly and the "*Agrotis segetum*," causing disease and death among them. In the case of the "*Tarichium megaspermum*" the spores are black in colour and provided with a thickened epispodium.

The above are mould fungi or hyphomycetes which belong to the hypodermii order. Yeast fungi and mould fungi, like bacteria or fission fungi, are achlorophyllous thallophytes intimately related to one another, but quite distinct from bacteria. Their germs are widely distributed in air, soil and water, and are the cause of various morbid processes and fermentations. Their importance in the biological and biochemical life-history of cancer phenomena in the human body from parasites introduced accidentally through bad hygienic and sanitary conditions, is of the utmost importance to those who enquire into the pathological changes in cancer. They might be considered the "A B C" of biochemical changes, whilst the parasites themselves which enter the suitable host are the "A B C" of the biological.

† "*Coccidæ*" which belong to the section "*monamera*," to which "*mealy bugs*"

are attacked in this way. This has actually been seen, and the experiment has been made with the embryos and the hosts which were placed together, and the latter were found by Von Siebold, in some cases 18 hours, and in others 24 hours, to have been attacked by the embryos.

Gordius has been found wandering into the bodies of "ephemera," which only occurs *at night* (Meissner), *vide* p. 63, Leuckart's work on "The Parasites of Man," translated by Hoyle.

Gordius is a thread-worm which differs from the real and typical nematodes in many ways, among which *atrophy* of the intestine, and the terminal position of the male and female sexual apertures, may be mentioned, which resemble in character the "*acanthocephalidæ*."

In the embryos of gordius we meet with relations which differ very little from those of the embryos of "echinorhynchus," which is worthy of note, since Moniez has reported finding "psorospermia" in "echinorhynchus proteus"; but what Moniez has described is, we are told by Leuckart, a "*micrococcus*" (panhistophyton), and therefore a *fungus* similar to those found by Bütschli in *oxyuris*, and also found in free-living *nematodes*.

The life history of this filaria-like nematode, points to some aquatic insect or larva, most probably a rotifer, or the May-fly in whose interior spores of algæ, crustacea and rotifera are found, in which they are sometimes parasitic. If, by any chance, it enter the human body, it probably either enters a *vein* or *lymphatic* where the eggs are deposited, and where it sets up changes leading to leucocythemia of a peculiar type, which leads either to a form of *lymphadenoma* or *myxædema*, or to *cancer*, probably through the *gordius* in the one case, and the *mermis* in the other.

I have seen a case of *cancer of the breast*, in which the symptoms previous to the cancer manifestation resembled *myxædema* very strongly. The breast was amputated, and a growth appeared in the other breast which gave suspicion of cancer from the history of the first case. On removal of the second breast early, the growth on examination proved not to be a cancer. The patient then was attacked in the uterine region, where there was every sign of a secondary infection present. Palliative treatment was administered, but death eventually took place some months after, and the cause of death was carcinoma.

Infection through the embryos of gordius might also occur through eating raw vegetables (cress and lettuce) in which young caterpillars containing such embryos are concealed, and since the embryos are capable of boring their way through tissues and migrating, any part or organ might be subject to infection in this manner. Chance determines many of the methods of infection. If we consider that rotifers, or wheel animalcules, follow the appearance of "*protococcus pluvialis*" (chlamydomonas) in the rain-water cisterns above referred to, and that these animalcules are also found in "sphagnum" or bog moss, and that the gordius embryos are found in invertebrate insects, terrestrial as well as aquatic,

and "bark lice" belong, and which are seen in abundance on apple trees, where whole branches are covered with a white down. The female coccus is a curious anomalous creature.

and that the rotifers are regarded as allied to the crustacea (termed by Prof. Leydig as "*cilio-crustaceans*," while Huxley states that they are more nearly connected with the "*annelida*," through their resemblance to the early larval forms of that class), we have every reason to see that there is a strong connection between the gordius and the rotifer (*cilio-crustacea*), as there is between bilharzia and the small fresh water crustacean (*amphypoda*) referred to by Sonsino.*

Moreover, "*monadinæ*" are not at all uncommon in the body cavity of rotifera and the "*alimentary canal of millipedes and insects*," and occasionally are also frequent in the whole tracts of the intestine of moths and flies.

Lewis describes a *hæmatozoon* ("*Herpetomonas Lewisi*") in 29 per cent. of the species of "*Mus decumanus*" and "*Mus rufescens*," which he at first thought were *vibrios* or *spirilla*; but he afterwards considered that they had many features in common with several of the species of Dujardin's "*cercomonas*," which led many observers to believe that these organisms are "*zoospores*" and *not animalcules*, although he considered them not unlike the flagellated parasite described by Bütschlii, who discovered a flagellated organism (*Leptomonas Bütschlii*) in the intestinal canal of a free nematode (*Trilobus gracilis*). I cannot help feeling that there is such a form of organism connected with the filaria-like nematodes, gordius and mermis, which also resembles a *cercomonas*. The *cercomonads are said*, after encapsulation, to become "*amœba*"—at least the parasitic forms of *cercomonads*.

We need, however, to remember that Moniez described "*psorospermia*" in "*Echinorhynchus proteus*," which were found after all to be a *fungus*, whilst Bütschlii found similar bodies to those described by Moniez in "*oxyuris*," and in free living nematodes.

The eggs of helminths have frequently been confused with bodies which are described as *psorospermia* (*coccidium* lt.), and *vice versa*. Considering that in the embryos of gordius we meet with relations which differ very little from those of the embryos of echinorhynchi, and that in the intestinal canal of free nematodes, bodies have been found by Moniez and Bütschlii respectively, which resemble "*psorospermia*," but which after all were pronounced to be *micrococcus* (*panhistophyton*), a *fungus*; and that a flagellated organism (*Leptomonas Bütschlii*) was found in the intestinal canal of a free nematode which forms stellate colonies, like the "*Surra*" parasite; we have to decide, therefore, whether, in cancer, the organism is a *psorosperm* or *egg of a helminth* which have been confused, but found after all to be a *micrococcus*, and therefore a *fungus* (*panhistophyton*). Whether the *hæmatozoon* or *herpetomonas*, which is also regarded as a *cercomonas* and a *leptomonas* by Lewis and Bütschlii respectively, is connected with the fungoid growths mentioned, is the point to be ascertained. Mitrophanow suggested that these organisms (*hæmatozoa*) in fish, were infusoria between the genera *cercomonas* and *trichomonas*, with great similarity to the *trichomonas* described in Lieberkuhn's glands of

* Leuckart tells us that the goose, so long as it lives in meadows, has its intestines filled with numerous helminths. This is a point to remember in "cancer fields," and their pasture land.

fowls and ducks (Eberth), and on account of their special habitat, Mitrophanow suggested a new term "*hæmatomonas*," defining the germs as parasites of normal fish blood, worm-like, actively moving organisms, with indistinct differentiation of body parenchyma. Bodies pointed both ends, 30 to 40 m. long, and 1 to $1\frac{1}{2}$ m. wide. May possess in front a flagellum, and on one side an undulating membrane.

The infusoria may be but larval forms of some higher organisms instead of being complete animals, and it is not impossible in this way they may be considered related to the rhizopod group with rotifera. The infusoria belong to a lower type than the rotifera, and prevail in infusions of organic matter in which the rotifera are not found. Notwithstanding this wide zoological separation between these two kinds of animalcules they should be treated in connection with one another.

Carpenter tells us that there is an extensive group which remains, the beings of which it is composed going through the whole of their lives, so far as we are acquainted with them, in a grade of existence which is essentially "*protozoic*." In their general organization, the wheel animalcules (rotifers) are considered members of the articulated division of the animal kingdom, and seem to constitute a class in that lower portion of it to which the designation "worms" is now commonly given.

From these facts which seem at first as heterogeneous as the animalcules, we cannot but see a strong affinity between the lowest types of plant and animal life (fungi, protophyta and protozoa), in which helminths and entozoa, together with insect life peculiar to the region or district, play a most important part on the surface of the earth as well as within the bodies of the lower animals and man producing diseases of the surface as well as of the internal mucous membranes, glands and tissues, by their combining forces, and at the junction of these, (skin and mucous membranes) certain diseases of a malignant type arise, viz., cancer of different forms and types of malignancy, which are possibly connected with the "flagellated organisms" described, which are stages in the life-history of a "myxomycete." Here we are once more face to face with a close affinity between the lowest forms of microscopic life, both plant and animal, which have many features in common with "motile" organisms of vegetable origin; but approach more closely to the animal, more particularly as Lewis has told us, to several of the species of Dujardin's *cercomonas*. These organisms (*cercomonas*) have been found in the intestinal canal of a free nematode (*Leptomonas Bütschlii*), which are described as "*flagellated organisms*," and form stellate colonies, like the Surra parasite in equines. When detached they present a somewhat spindle-shaped body, about half the length of the "flagellated organism," in the rat's blood which was found by Lewis, and which Kent named "*herpetomonas Lewisi*." Owing to the function of *propelling* with the "*flagellum*" instead of *drawing* this animalcule through the inhabited serum, as Lewis maintained, there was a structural and a functional feature which Kent recognized as having no parallel among other representatives of these "protozoa flagellata," the recognition of which he said "would demand the

creation of a distinct generic and family group for the reception of these singular organisms." What are they? We cannot, therefore, resist accepting the term "*protomyxomyces*" as used by Cunningham towards such organisms of a group related to diseased conditions in the blood and tissues of the lower animals and man, which claim allegiance in a manner to both the vegetable and the animal, and when detached or interfered with from their normal position and conditions, assume a different form and fuse themselves with the cells of the particular region they inhabit by losing their identity, and which, under certain conditions, take up a mimic form and cause an alteration in the general metabolism setting up ferments which lead to growths by the processes mentioned in pages 39-43. We have an analogy in certain "*leguminosæ*," in which certain organisms, together with the cells of the plant, the soil and atmospheric conditions and surroundings, build up "*nodules*." The process is simpler in plants than in animals, but still more complex in man who is *omnivorous* in his habits and has devised artificial methods of living and sanitation.

In malaria, in tropical regions, we see a preparation of the human blood by anæmia for malarial attacks in man; in temperate countries, there are conditions which are different to tropical, where there is a tendency to chronicity in disease processes which attack the human being under the most favourable conditions in particular districts known as "cancer fields." This is a preparation of the soil for cancerous changes under such conditions as leucocythæmia of a particular type, so that we have an analogy in plant as well as in animal life for the processes at work in cancer.

The different forms of cancer and degrees of malignancy of that disease, might be explained by the different "flagellated organisms" which Cunningham describes in the life-history of a "*myxomycete*," and which different forms, probably occur under certain favourable conditions in aquatic insects, crustaceans, fishes and frogs, terrestrial and aquatic birds and animals, particularly those which are consumed by man in "cancer fields," or which have taken their food from such fields and pastures and so become infected with parasitic life and entozoa, which have thereby created disease. Man, by close contact in his domestic life with such animals, or, through food, has by chance become infected, either directly, or through bites of insects, and has accidentally become inoculated and so developed cancer. Inoculation through insects, from man to man, and not from animals to man, is possible therefore at the most favourable time for such growths to take root and develop, viz., the middle period or menopause. In the case of experimental tests in animals infected with cancer, the failure is due most likely to disparity in age between the infected animal and the one used as a test experiment.

A COMPARATIVE STATISTICAL STUDY OF CANCER MORTALITY.

By permission, from the British Medical Journal.

COUNTY.	Death-rate from Cancer per 100,000 Living at all Ages.	Proportion of Deaths from Cancer to Total Deaths.
Huntingdon	108.3	6.6
North Wales	106.3	5.7
Cambridgeshire	103.3	6.4
Berkshire	100.2	6.8
Norfolk	99.1	5.5
Suffolk	99.1	5.8
London	96.4	5.1
Devonshire	96.4	5.5
Lancashire	73.0	3.4
Rutland	71.9	5.4
Middlesex	71.3	4.8
Essex	70.4	4.3
Staffordshire	68.5	3.3
South Wales	65.8	3.5
Durham	61.9	3.2
Monmouth.. .. .	60.6	3.2

Death-rate from Cancer per 100,000 Living.

ENGLAND AND WALES		.. .. .	67.6
Huntingdon	110.8	Lancashire	55.5
North Wales	87.1	Rutland	103.6
Cambridgeshire	93.9	Middlesex	60.2
Berkshire	76.9	Essex	56.0
Norfolk	78.1	Staffordshire	53.8
Suffolk	77.9	South Wales	56.3
London	78.6	Durham	51.8
Devonshire	84.7	Monmouth	50.4

Corrected Death-rate from Cancer per 100,000 Living aged 35 Years and Upwards.

ENGLAND AND WALES		.. .. .	184.4
London	225.0	Cheshire	177.5
Huntingdon	215.7	Norfolk	174.9
Cambridgeshire	201.2	Hertfordshire	173.2
Sussex	199.9	Yorkshire (W. Riding)	170.6
Warwickshire	197.6	Suffolk	169.6
Cumberland	191.4	Westmoreland	166.3
N. Wales	191.4	Leicestershire	166.3
Northumberland .. .. .	.. .. .	Essex	165.3
Surrey .. .. .	.. .. .	Somersetshire	164.7
Yorkshire (N. Riding) .. .. .	.. .. .	Herefordshire	163.0
Northamptonshire .. .. .	.. .. .	Lancashire	160.4
Middlesex	188.1	Durham	159.7
Devonshire	183.5	Staffordshire	157.8
Yorkshire (E. Riding) .. .. .	.. .. .	Rutland	157.8
Gloucestershire .. .. .	.. .. .	Worcestershire	157.4
Berkshire	181.8	S. Wales .. .. .	.. .. .
Kent .. .. .	.. .. .	Cornwall .. .. .	.. .. .
Nottinghamshire .. .. .	.. .. .	Wiltshire .. .. .	.. .. .
Lincolnshire .. .. .	.. .. .	Derbyshire .. .. .	.. .. .
Shropshire .. .. .	.. .. .	Buckinghamshire .. .. .	.. .. .
Hampshire .. .. .	.. .. .	Dorsetshire .. .. .	.. .. .
Bedfordshire .. .. .	.. .. .	Monmouthshire .. .. .	.. .. .
Oxfordshire .. .. .	.. .. .	.. .. .	.. .. .

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes.
Liverpool, including Toxteth Park and W. Derby	77.0	3.3
Manchester, with Salford, Chorlton, and Prestwich	78.8	3.3
Birmingham with Aston	85.7	4.0
Leeds	106.0	5.0
Sheffield	81.7	3.4

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Cancer Deaths to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Per- sons of 30 Years and upwards.
SCOTLAND	81.0	4.4	8.2
Principal Town Districts	85.0	4.2	8.6
Large Town Districts	71.7	3.8	7.0
Small Town Districts	73.0	4.3	10.4
Mainland Rural Districts	89.5	5.6	8.5
Insular Rural Districts	66.0	4.1	5.5

Nairnshire	9.73	Elginshire	5.95
Forfarshire	7.74	Kinross-shire	5.93
Buteshire	7.60	Kirkcudbrightshire	5.84
Dumbartonshire	7.36	Caithness	5.84
Roxburgh	7.04	Perthshire	5.71
Dumfriesshire	6.70	Fifeshire	5.60
Wigtownshire	6.67	Haddingtonshire	5.58
Banffshire	6.63	Argyllshire	5.52
Selkirkshire	6.60	Clackmannan	5.51
Berwickshire	6.40		

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes after Correction by Dr. Robertson for Deaths in Public Institutions.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Persons of 30 Years of Age and upwards.
Glasgow	82.0	3.8	2.98
Edinburgh	107.0	5.6	4.03
Dundee	115.0	5.8	4.09
Aberdeen	95.0	5.2	4.53

	Death-rate from Cancer per 100,000 Living.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all causes in Persons of 35 Years of Age and upwards.
IRELAND	65.0	3.6	5.9
Leinster	72.0	3.6	5.7
Munster	49.4	3.0	4.7
Ulster	77.0	4.1	6.6
Connaught	48.0	3.4	4.9

	Death-rate from Cancer per 100,000 Living, Average 1897- 1901.*	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes in Persons 35 Years of Age and Upwards.
Dublin County and County Borough	84·8	3·3	6·2
Wexford	62·2	4·0	6·0
Cork County and County Borough	55·6	3·5	5·7
Limerick County and County Borough	49·2	2·7	4·3
Tipperary	59·8	3·0	4·3
Antrim	69·6†	5·3	8·3
Down	68·7†	2·7	4·1
Belfast County Borough	†	2·8	6·7
Armagh	104·7	5·6	8·3
Donegal	56·0	3·9	5·6
Londonderry County and County Borough ..	82·4	4·7	7·3
Tyrone	73·3	4·6	6·4
Galway	41·9	3·5	5·0
Mayo	36·4	3·2	4·8

* Registrar-General's Special Report on Cancer in Ireland.

† The Registrar-General includes part of Belfast in each of the Counties Antrim and Down.

Death-rate from Cancer and Tumour per 100,000 Living.

FRANCE. ALL TOWNS ABOVE 3,000 INHABITANTS				104·0
All towns from 500,000 to 100,000 .. ..	..	..	..	120·0
" " 100,000 to 30,000 .. ..	..	..	..	110·0
" " 30,000 to 20,000 .. ..	..	..	..	100·0
" " 20,000 to 10,000 .. ..	..	..	..	94·9
" " 10,000 to 5,000 .. ..	..	..	..	76·0
Chefs lieux d'arrondissement under 5,000 inhabitants .. ..	..	..	..	80·0

Departments in the Towns of which the Highest Mortality from Cancer was shown in 1900.

	Death-rate from Cancer and Tumour per 100,000 Living, at all ages.	Proportion of Deaths from Cancer and Tumour to 100 deaths, from all Causes, at all ages.	Proportion of Deaths from Cancer and Tumour to 100 Deaths from all Causes of Persons 40 Years of Age and Upwards.
Eure et Loire	167·0	6·5	10·2
L'Aisne	161·0	6·6	11·5
Rhone	153·0	6·1	10·1
Seine et Oise	150·0	4·9	10·0
Seine (excluding Paris)	150·0	5·2	9·4
Seine Inférieure	149·0	5·0	10·9
Marne	143·0	6·4	11·7
Loiret	142·0	6·6	10·0
Somme	141·0	6·0	10·6
L'Indre	141·0	6·5	10·0
Seine et Marne	140·0	6·3	10·1
L'Osie	136·0	5·0	9·1
Nièvre	136·0	6·0	8·7
Côte d'Or	135·0	7·0	9·5
L'Isère	130·0	5·6	9·5
Nord	109·0	5·0	10·9

Departments in the Towns of which the Lowest Mortality for Cancer was shown in 1900.

	Death-rate from Cancer and Tumour per 100,000 Living, all ages.	Proportion of Deaths from Cancer and Tumour to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer and Tumour to 100 Deaths from all Causes of Persons 40 Years of Age and Upwards.
Côtes du Nord	98·0	3·0	5·2
Calvados	94·0	2·9	4·7
Hérault	85·0	2·9	5·1
Charente Inférieure	78·0	3·5	5·7
L'Aude	74·0	2·7	3·7
Cher	70·0	3·2	4·6
Morbihan	65·0	2·7	5·4
Bouches du Rhone	62·0	2·3	4·2
Vienne	59·0	3·0	4·8
Manche	58·0	2·1	3·9
Puy de Dôme	53·0	2·6	3·0
Maine et Loire	52·0	2·0	3·2
Vosges	51·0	2·3	4·3
Finisterre	38·0	1·5	3·2

	Death-rate from Cancer and Tumour per 100,000 Living at all ages.	Proportion of Deaths from Cancer and Tumour to 100 Deaths from all Causes at all Ages.	Proportion of Deaths from Cancer and Tumour to total Deaths of Persons over 40.
Paris	121·0	5·7	10·7
Lyons	153·0	7·1	11·7
Rouen	173·0	5·8	10·6
St. Etienne	160·0	6·8	11·4
Havre	140·0	4·1	10·1
Toulouse	136·0	5·6	8·3
Nantes	128·0	5·1	8·8
Lille	124·0	5·3	12·7
Bordeaux	97·6	4·5	7·2
Marseilles	69·0	2·5	5·0

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Persons 15 Years of Age and Upwards.
GERMAN EMPIRE	72·7	3·3	6·6
Prussia	59·3	2·7	5·6
Bavaria	102·0	4·2	8·2
Kingdom of Saxony	94·7	4·1	9·3
Wurtemberg	94·0	4·4	8·6
Grand Duchy of Baden	102·0	5·0	8·8
Hesse	95·0	5·2	8·6
Saxe Meiningen	63·0	3·3	5·9
Brunswick	94·0	4·6	8·9
Saxe Altenburg	78·0	3·2	7·0
Saxe Coburg Gotha	54·0	2·7	4·6
Anhalt	84·0	4·2	8·0
Schwartzburg Sondenheim	68·7	3·5	6·4
Waldeck	64·0	3·5	6·0
Reuss	79·4	3·5	8·0
Schaumburg Lippe	47·0	3·0	4·6
Lippe	65·2	3·7	6·4
Alsace-Lorraine	79·3	3·9	6·5

Death-rate from Cancer per 100,000 Living.

Bavaria, right of the Rhine	..	..	..	..	..	102·3
Bavaria, left	..	..	..	..	..	73·3

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Persons 40 Years of Age and Upwards.
East Prussia	54·3	2·1	4·6
West Prussia	50·4	1·9	5·1
Berlin	109·1	5·8	13·8
Brandenburg	66·7	3·1	7·1
Pomerania	67·1	2·8	6·6
Posen	44·5	1·8	5·2
Silesia	54·2	2·1	5·1
Saxony	62·1	2·8	7·5
Schleswig-Holstein	76·3	4·3	8·4
Hanover	79·1	4·3	6·4
Westphalia	43·0	2·1	5·7
Hesse Nassau	57·1	3·2	6·0
Rhine Provinces	53·2	2·5	5·6
Hohenzollern	67·3	2·8	5·4

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Persons 40 Years of Age and Upwards.
Berlin	109·1	5·8	13·8
Breslau	109·0	4·2	9·8
Colonge	91·8	4·0	11·3
Kiel	113·0	6·9	17·4
Düsseldorf	61·1	3·2	9·3

	Death-rate from Cancer per 100,000 Living, all ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Persons of 40 Years of Age and Upwards.
EMPIRE OF AUSTRIA	70·4	2·7	7·5
Lower Austria	108·0	4·9	11·9
Lower Austria (without Vienna)	104·0	4·3	11·5
Vienna	112·0	5·5	12·1
Upper Austria	115·0	4·6	9·6
Salzburg	133·0	5·2	11·2
Styria	77·3	3·3	7·1
Carinthia	92·6	3·6	7·2
Carniola	41·8	1·6	4·0
Küstenland (Görz, Istria, and Trieste)	63·0	2·3	6·1
Tyrol and Vorarlberg	107·0	4·2	8·6
Bohemia	91·8	3·8	9·6
Moravia	83·7	3·3	8·6
Silesia	61·1	2·2	6·5
Galicia	28·3	1·0	3·5
Bukowina	37·6	1·4	4·7
Dalmatia	19·0	0·8	2·0

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Persons of 40 Years of Age and Upwards.
KINGDOM OF HUNGARY	32·8	1·2	3·7
Hungary	39·3	1·4	4·4
Croatia, Sclavonia	16·5	0·6	1·9

UNITED STATES.

Highest.

Lowest.

Pacific Coast region	51·9	Gulf Coast region	20·2
Heavily timbered region in the N.W.	46·8	South Central Appalachian region	20·0
North Eastern hills and plateaus ..	44·5	South Atlantic coast	18·7
Prairie region	43·0	South Interior plateaus	18·1
Atlantic Coast region	41·5	Mississippi river belt	11·3

Death-rate from Cancer and Tumour per 100,000 Living.

White	66·7
Chinese	49·4
Negro	48·0
Indian	28·6
Foreign born	124·6

Death-rate from Cancer per 10,000 Living.

	All Ages.	45-64	65 and over.
Both parents native	48·3	145·0	349·0
Mothers born in France	92·8	212·0	428·0
" " Scotland	81·8	151·0	533·0
" " Germany	78·2	226·0	530·0
" " Ireland	76·4	215·0	452·0
" " England and Wales	72·0	171·0	415·0
" " Hungary and Bohemia	81·5	258·0	530·0
" " Scandinavia	81·1	148·0	271·0
" " Russia and Poland	25·7	245·0	654·0
" " Italy	22·8	115·0	372·0

	Death-rate from Cancer per 100,000 Living, all ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all ages.	Death-rate from Cancer per 100,000 Living, of 35 Years of Age and upwards.
Total registration area	60·0	3·4	163
Maine	85·7 { 81·0 urban 84·2 rural }	4·9	201
Vermont	81·8 { 72·9 urban 83·2 rural }	5·3	200
New Hampshire	66·8 { 48·5 urban 78·4 rural }	4·0	157
Massachusetts	66·4 { 62·4 urban 79·4 rural }	4·0	181
Rhode Island	62·3 { 56·1 urban 74·3 rural }	3·2	168
Michigan	61·4 { 61·4 urban 56·6 rural }	4·6	163
New York	61·2 { 60·0 urban 63·6 rural }	3·7	168
Connecticut	61·1 { 59·9 urban 63·3 rural }	3·9	164
New Jersey	50·4 { 49·1 urban 52·1 rural }	3·2	145

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.	Death-rate from Cancer per 100,000 Living, aged 35 Years and upwards.
Chicago.. ..	63·3	3·9	202·0
New York	64·7	3·1	203·0
Philadelphia	73·6	3·4	203·0
San Francisco	112·0	5·5	236·0

	Death-rate from Cancer per 100,000 Living at all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes.
SWITZERLAND	132·0	7·0
Cantons of		
Lucerne	204·0	11·5
Appenzell-i-Rhine	193·0	7·8
Unterwalden nid dem Wald	189·0	10·0
Zug	184·0	10·2
Schwyz	171·0	8·7
Glarus	171·0	10·0
Unterwalden ob dem Wald	170·0	10·0
Aargau	165·0	8·4
Schaffhausen	163·0	10·0
Thurgau	161·0	9·9
St. Gall	160·0	9·3
Zurich	151·0	8·3
Geneva	140·0	7·0
Appenzell-a-Rhine	139·0	7·9
Solothurn	130·0	6·6
Uri.. .. .	127·0	6·1
Basle (Town)	124·0	7·0
Vaud	122·0	6·5
Fribourg	120·0	5·5
Grisons	107·0	5·6
Berne	105·0	5·6
Basle (Country)	107·0	6·0
Neuchatel	103·0	6·2
Ticino	88·0	3·8
Valais	36·0	1·7

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes, all Ages.
KINGDOM OF ITALY*.. .. .	52·1	2·3
Tuscany	83·0	4·1
Emilia	78·5	3·6
Lombardy	70·8	3·0
Marches	63·1	2·9
Liguria	59·3	3·0
Umbria	54·3	2·6
Lazio (with Rome)	53·8	2·7
Venetia	51·9	2·6
Piedmont	50·9	2·8
Campagna	38·0	1·6
Abruzzo and Molise	35·4	1·5
Sicily	34·3	1·4
Apulia	30·8	1·2
Basilicata	30·4	1·2
Calabria	30·6	1·3
Sardinia	19·0	0·7

* The proportion of deaths from cancer to 100 deaths from all causes of persons of 40 years of age and upwards in the whole of Italy was 5·1.

	Death-rate from Cancer per 100,000 Living at all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes at all Ages.
Florence	137.0	6.1
Milan	101.0	4.6
Venice	103.0	3.7
Rome	77.7	3.9
Naples	56.7	2.3

	Death-rate from Cancer per 100,000 Living all Ages.	Proportion of Cancer Deaths to 100 Deaths from all Causes, all Ages.	Death-rate from Cancer per 100,000 Living of Persons 23 Years of Age and upwards.
KINGDOM OF HOLLAND	91.3	5.1	171
North Holland	94.9	5.7	184
South Holland	84.2	4.9	173
Zeeland	102.0	5.5	204
North Brabant	93.0	4.3	171
Guelderland	88.8	4.9	178
Utrecht	90.2	5.0	182
Overijssel	87.5	4.7	176
Drenthe	77.3	4.3	152
Groningen	97.3	6.0	194
Friesland	110.0	6.7	211
Limberg	87.4	4.8	175

Communes of	Death-rate from Cancer per 100,000 Living at all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes in Persons of 20 Years of Age and upwards.
Amsterdam	97.5	10.0
Utrecht	90.3	8.5
Hague	89.6	9.7
Rotterdam	87.3	10.0

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Cancer Deaths to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Persons of 30 Years and upwards.
NORWAY	84.5	5.0	9.1
Jarlsberg	120.0	6.1	10.0
Hedemarken	112.0	6.6	11.4
North Trondjem	111.0	7.0	10.8
Akerhus	103.0	5.4	9.2
Nedemaes	92.2	5.4	8.5
Bergen*	92.0	5.8	11.4
South Trondjem	90.1	4.9	8.6
Smaalenes	89.0	5.1	9.0
Bratsberg	88.0	5.3	8.6
Buskerud	83.6	4.6	9.0
Romsdal	83.7	5.3	9.0
Christians	82.6	5.2	8.4
North Bergenhus	76.4	5.2	8.3
Lister or Mandel	75.6	4.2	7.0
Stavanger	72.2	4.2	7.0
Nordland	70.4	5.0	9.5
Tromso	70.0	4.5	9.0
Christiania	66.3	3.5	8.0
South Bergenhus*	63.9	4.3	6.9

* The low rate of South Bergenhus and the high rate of the town district of Bergen are probably correlative.

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Cancer Deaths to 100 Deaths from all Causes, all Ages.	Proportion of Deaths from Cancer to 100 Deaths from all Causes of Persons of 40 Years of Age and upwards.
SWEDEN (ALL TOWNS)	102·0	6·4	—
Norrköping	117·0	8·0	16·0
Stockholm	110·0	7·0	14·1
Göteborg	100·0	6·0	13·6
Malmö	80·3	5·4	11·4

Proportion of Cases of Cancer to 100 of other Diseases Treated in Dispensaries and Medical Institutions in Indian Provinces.

Madras	0·024	Burmah	0·610
Bombay	0·050	Central Division	0·700
Bengal	0·025	Assam	0·005
Agra and Oudh	0·050	Berar	0·700
Punjab	0·700		

	Death-rate from Cancer per 100,000 Living, all Ages.	Proportion of Cancer Deaths to 100 Deaths from all Causes, all Ages.	Death-rate from Cancer per 100,000 Living, 1890.
New South Wales	57·4	4·5	45·1
Victoria	72·0	5·0	61·6
Queensland	46·4	3·5	30·5
South Australia	57·6	5·1	49·5
West Australia	30·2	2·2	35·8
Tasmania	56·8	4·7	51·5
New Zealand	60·6	5·9	48·4

	Pounds of meat Consumed per Head of Population.	Pounds of Grain Consumed per Head of Population.
United Kingdom	109	378
France	77	540
Germany	64	550
Holland	57	560
Switzerland	62	440
United States	150	370

	Gallons of Wine Consumed per Head of Population.	Gallons of Beer Consumed per Head of Population.	Gallons of Spirits Consumed per Head of Population.
United Kingdom	0·39	31·70	1·12
France	23·50	7·00	2·30
Italy	22·00	0·15	2·90
German Empire	1·60	31·20	2·20
(a) Alsace Lorraine	—	21·50	—
(b) Bavaria	—	62·00	—
(c) Baden	—	42·50	2·80
(d) Wurtemberg	—	48·00	—
Austria	3·75	18·00	2·50
Hungary	3·50	2·25	2·75
Holland	4·50	—	2·00
Switzerland	16·75	17·50	1·50
Norway	—	5·60	0·82
United States	0·40	16·00	1·27

XXI.

[*From the British Medical Journal.*]

“General Summary.—In examining the general conclusions to be arrived at from the consideration of the regional distribution of cancer, it may at first be pointed out that only in a few instances can these be of a positive or decided character, and if this be thought unsatisfactory, the excuse may be made that the calculation was not commenced with the view of proving any preconceived theory, but to discover what inference might naturally be drawn from the study of the figures by an impartial mind.

The facts before us give little support to the view that the distribution of cancer is entirely dependent upon the geological conformation of various districts. It is true that a high cancer rate is noticeable on the clays of Cambridge and Sussex, and on the alluvial soil of Holland, but similar high rates are found among populations living on the igneous rock of Cumberland and North Wales, on the carboniferous strata of Bohemia, and on the palaeozoic rocks of Norway. In fact, the strata of every geological period show alike areas of high and others of low mortality, although the former are perhaps more often found on recent deposits.

“It will have been noticed that the areas of high mortality are not uncommonly situated in the colder portion of the country, but this fact is scarcely sufficiently well marked to justify the conclusion that climate is a very potent influence in this respect. With regard to rainfall, the facts which were given in detail for England could only lead to a negative conclusion, and the same may be said of other countries, though it has not been thought necessary to give details as to the average rainfall.

“Elevation is another point which seems to be of comparatively little importance, for although the high mortality area in Holland, like that of Cambridgeshire, is of course extremely low-lying; on the other hand, the majority of such areas appear to be situated in hilly districts of which North Wales, Bavaria, and Baden may be instanced with the mountain region of Norway and most of the country about the Alps. A difference of opinion has long existed on this question, for while some have looked upon low-lying lands as the natural home of cancer, there have always been others who have pointed out that the disease is more prevalent on the tops of hills.*

“The figures give more support to the view so largely held that the valleys of great rivers are favourable to the production of cancer. It has long been known in this country that the Thames Valley is an especially favourable locality for the occurrence of malignant growths, and it will be now noticed that a high death-rate obtains along the whole valley of the Danube to the Hungarian frontier, and along a great part of the valleys of the Rhine and

* Butlin, “Collective Committee of British Medical Association.”

Elbe. Also in France the same fact is observable with regard to the Seine, Marne, and Oise.

"On this point, however, there is also a certain amount of contradictory evidence. The counties bordering on the Severn Valley have never shown a great mortality from cancer, while we find in France few areas of high mortality in the valley of its principal river, the Loire, and the department of the Bouches du Rhone is one of those coming lowest on the list.

"Altogether, therefore, it seems very doubtful whether there is any persistent prevalence of cancer among populations living in river valleys and whether, where this occurs, it may not be due to some superadded condition. In fact, cancer appears to be common wherever water abounds, be it in the form of river, lake, or marsh, a fact which is exemplified in Switzerland, Bavaria, and Holland. No doubt this is due to the intimate relation which exists between abundance of water and vegetation. Along the Rhone, however, we find low cancer mortality everywhere except in the immediate neighbourhood of the city of Lyons, and the middle portion of the Rhine valley shows no excess of deaths from malignant disease, though the rate is very high about its upper portion, as well as in the Dutch provinces near its mouth.

"A careful study of the tables given for each country leads to the conclusion that one geographical feature has a very important influence. In almost every case it will be found that districts of high cancer mortality are also forest, or at least well-wooded districts. This is especially noticeable in France and Germany; but in Austria, Switzerland, and Italy alike the highest rate is found in parts of the country largely covered by woods. It is even more striking that areas which have been deforested are almost invariably areas of low mortality, such as the canton of Ticino in Switzerland, and Istria and Dalmatia in Austria.

"The idea that trees may play a part in the production of cancer is not a new one, Noel* having pointed out as long ago as 1897 that the inhabitants of isolated houses surrounded by trees are specially liable to suffer from this malady, and that the disease is particularly prevalent among forest guards. Lloyd Jones, in reviewing the incidence of cancer in Cambridgeshire, also noted the fact that it was more common in the neighbourhood of trees. Noel suggests that cancer may be directly derived from a somewhat similar disease which occurs in trees, and which is known as "canker."† Without, however, assenting to this statement, for which proof seems to be altogether wanting, it cannot be doubted that trees have a very serious and potent influence on those who live in their neighbourhood, and which seems beyond question to make them more prone to suffer from cancer.

"There remains for consideration the question whether any inferences can be drawn as to those conditions of life which most predispose to malignant growths.

"Both wealth and poverty have been accused by different authors of having an evil influence in this respect.

* Noel, *Revue des Maladies Cancerieuses*, 1897.

† Marshall, "Diseases of Trees."

"The conclusions to be drawn from the figures before us are not very definite. In considering countries as a whole it appears that the disease is more common in rich countries such as England, France, Holland, and Bavaria, while the lowest rates are among the poorer nations, Italy and Ireland. It is, however, difficult to judge whether this cause has any influence as regards the rates in different districts of the same country, as in many of them the poorer parts would be the regions in which diagnosis and registration would be most faulty.

"It was frequently found that the rural portions of the population suffered more than the urban, a fact now sufficiently well understood, although in former years the contrary was supposed to be case. That an excessive mortality occurs in the large towns of Prussia and France is probably due to the facility of communication and the multiplicity of public institutions, owing to which sufferers from cancer usually come into towns for treatment. This is well explained by De Bovis*. Agricultural districts appear, on the whole, to suffer more than industrial; this is by no means invariable, but is so general as to suggest that where it is not evident there is some special cause to account for the fact.

"With regard to special articles of diet, there appears to be absolutely no evidence that the consumption of a large quantity of meat is a cause of cancer. This is not only established by the table as to the quantity of meat consumed in different countries, but also by the fact just alluded to that cancer is more prevalent among the agricultural population, who eat but little meat, than among the well-nourished inhabitants of towns and of the seats of wealthy industries. Moreover, cancer is not scarce among races who eat little or no meat, such as the Hindus and Chinese, and among the very small meat eaters of Italy and Norway.

"Fish eaters, on the other hand, may perhaps have a somewhat increased tendency to malignant disease. Both in England and America sailors and fishermen among occupied males show a high rate; but, on the other hand, it must be pointed out that the Bretons, who are largely a fishing population, suffer but little, and that the greatest mortality often occurs in inland districts where fish can form but a very small element of the diet.

"Braithwaite's suggestion that salt influences the production of cancer seems to be founded on a fallacy, as he supposes that cancer does not occur among Jews, which is certainly not correct. The high rate in the Salzkammergut might be noted as a point in favour of the suggestion; but, on the other hand, the kingdom of Saxony, which shows the highest rate for the whole of Germany, is almost the only country in that empire in which salt is not found."

(The above are published in support of my arguments as to the origin of cancer, and the close relation of the vegetable with the animal).

"In dealing with the table on the consumption of alcoholic liquors in various countries, it has already been pointed out that the

* "L'Augmentation de Fréquence du Cancer." *Semaine Médicale*, September 10, 1902.

statistics seem to give very strong ground for the belief that the consumption of beer is a predisposing cause of cancer. On referring to the figures for cancer distribution generally, we find this impression strongly confirmed. In almost every country in which the staple drink varies in different parts, it is found that the highest rate is in those districts in which beer and cider are most used. It is especially noteworthy that the Bavarians, who consume a larger amount of beer per head than in any country in the world, show an extremely high cancer-rate; and Lille, where far more beer is drunk than in any other French city, gives the largest percentage of cancer among persons over 40 years of age.

"As to the question of the effect of alcohol generally in the production of the disease the evidence is more doubtful, and the indications given by the table just referred to are not very clear. The fact that persons engaged in the liquor trade suffer unduly gives some support to the idea that the consumption of alcohol may have some influence in predisposing to cancer. Chimney sweeps also have a high mortality from alcoholism, and seamen, another class with a high cancer mortality, are not usually considered to be very temperate. On the other hand, the study of the Registrar-General's table for deaths amongst those engaged in various occupations shows that the rate of death from cancer is not at all in proportion to the rate from alcoholism. It is also noticeable that districts in which special temperance legislation exists, such as the State of Maine, do not from this cause show a low cancer mortality. Altogether the evidence on this point is not very convincing, but, on balance, tends to establish some slight relation, although not nearly so definite and certain as in the case of beer.

"One of the most striking features in the local distribution of cancer is the effect of race in varying the rate of mortality, the Scandinavian and Teutonic races suffering apparently always to a greater and the Latin, Slav, and Celtic to a less degree. This is not only evident when countries are considered as a whole, but is clearly exemplified in the different provinces of Austria and almost as distinctly in France and Prussia. At first sight this would appear to furnish a strong argument for those who urge that cancer is usually hereditary. The point, however, has aroused considerable attention in the United States, where the statistics for each race have been carefully calculated, and it is remarkable to find that the change of environment has in many cases materially altered the comparative liability to suffer from malignant growth. This fact suggests the probability that it is not race alone, but the diet and habits of different peoples which constitute the important element of the difference.

"The existence everywhere of areas of high and of low mortality from cancer is difficult of explanation by any theory of the etiology of the disease which excludes the existence of a specific cause. It is not altogether easy to understand that the habits and diet of the people in different parts of the same country can differ so greatly as to account for the difference in the rates.

"This is the case when such areas as North and South Wales, or Northern France east and west of the Seine, are considered, and

the fact is emphasized by investigations which have been made in more limited districts by various observers both here and abroad. Some account has already been given of the remarkable prevalence of cancer found by Arnaudet in certain villages in Normandy. Similar facts have been noticed by Guelliot* and others, and in this country by Lloyd Jones† and Nason.‡ The existence also of 'cancer houses' is vouched for by all the observers above mentioned, Guelliot giving an instance which came under his personal notice in which four persons died of cancer in the same house within the space of five years. Several doctors among those who replied to the German Statistical Committee on Cancer,§ gave instances of the same character, and others are furnished in the replies to the Registrar-General for Ireland ||

"The experiments of Moreau¶ and Langenbeck, who successfully inoculated malignant growths from one animal on another of the same species, and similar experiments which had been made from time to time by other pathologists, had long suggested the possibility that cancer was contagious, or at least inoculable. Evidence is now accumulating that the disease may be contagious in human beings. Numerous individual instances suggesting the probability of contagion as a cause have been published for many years past in the medical journals both here and elsewhere. Special interest, therefore, attaches to the statistics as to the incidence of cancer among nurses and servants of the United States, America.

"This exceptionally high mortality among women who are more likely than any others to be brought into intimate contact with sufferers from the disease would, if confirmed by the experience of other countries, afford the strongest evidence of the contagious character of cancer. The clinical features also, especially the tendency to metastasis, indicate an infective quality. In fact both in the character of the malady and in its distribution we find a very close analogy to many disorders which are known to own their origin to a micro-organism.

"On the other hand, there is overwhelming evidence to show that a part of the body attacked by malignant growth has often been previously exposed to continual irritation. This has given rise to the view so widely held that persistent irritation is the true and effective cause. It is possible that the two theories may be harmonized, if cancer be caused by a bacillus somewhat similar to the leprosy bacillus of which Impey** says that, in order to develop, 'it must in the first place come into contact with a person specially prepared to receive it by external conditions or constitutional debility; it then remains quiescent until stirred into activity by an exciting cause, until which time it circulates harmlessly in the lymphatics.' If a bacillus of cancer should be ultimately discovered, it may well be that, like the bacillus leprae, it remains

* Guelliot, *Gazette des Hopitaux*, November 12, 1892.

† Lloyd Jones, *British Medical Journal*, 1889, p. 813.

‡ Nason, *Ibid.*, March 12, 1898.

§ *Bericht über die vom Komitee für Krebsforschung.*

|| "Special Report of Cancer in Ireland."

¶ Moreau, *Archives de Médecine Expérimentale*, September, 1894.

** Impey, "On Leprosy."

dormant even in a favourable soil, until urged into activity by an exciting cause in the form of some chronic local irritation.

“The disputed question as to the bacterial origin of cancer must necessarily remain *sub judice* until the bacteria can be isolated and successfully cultivated, but it is difficult to account for the mode of distribution of the disease without admitting the existence of some definite external cause. This cause, micro-organism or other, is to be sought for in thickly-wooded localities, whence it may readily be distributed by Nature’s agents, wind and water, especially by the latter. Direct contagion would do the rest. It seems not unlikely that the puzzling contradictions as to the geological and geographical characters of areas of high cancer mortality are due to the fact that certain of such characters are favourable to the production of cancer, only in so far as they may be favourable to the growth of certain forms of vegetation. It is also probable that certain species of trees have more influence on the cancer mortality than others.

“The suggestion that arsenic predisposes to the development of malignant disease has been prominently brought before the notice of the profession recently, especially by Mr. Jonathan Hutchinson. The extraordinary tendency of chimney sweeps to suffer from cancer is the main foundation for the statement, soot usually containing arsenic. Some support is lent to the theory by the high mortality among copper miners, and if it be found that beer usually contains arsenic the argument would be greatly strengthened. On the other hand the absence of any excessive cancer mortality among the arsenic eaters of Styria is striking, and the low mortality in many coal-mining districts is certainly not favourable to the contention. To decide this question by statistics it would be necessary to examine into the cancer-rate among those occupied in the many industries in which arsenic is largely employed; this would naturally form part of any investigation as to the incidence of cancer among the populations of large towns.

“The definite conclusions of a positive character which appear to result from the present inquiry are:—

1. “That certain races are especially prone to cancer, more particularly the Scandinavian and the different branches of the Germanic family.

2. “That cancer is more prevalent in districts in which beer is the staple drink and the excess is in some degree proportionate to the amount consumed per head.

3. “That cancer tends to cause excessive mortality in regions abounding in water, but to a much more marked extent when these are covered with woods or forests. The mortality is also usually high along the valleys of rivers flowing from such districts.

4. “That the regional distribution of cancer indicates the probability that the disease is due to a specific cause.

“To confirm or correct these conclusions it would be desirable to divide some district of high cancer mortality, such as the Department of the Aisne in France, the Canton of Lucerne in Switzerland or Swabia in Bavaria, into small areas, and to gradually narrow the circle of the inquiries until the exact localities can be found and compared in which cancer is most distinctly endemic. The

difficulty of the task will chiefly consist in the absence of published figures to enable a judgement to be formed as to the prevalence of cancer in villages after all sources of error have been avoided.

"It is also necessary to find some explanation of the varying rates of mortality in different towns and with that view to examine carefully into the sources of the water-supply, while at the same time noting the food, habits, and occupations of the inhabitants.

"The writer feels that this is a very imperfect contribution to the statistics of cancer, but he hopes that it may pave the way for further inquiries."

It is necessary I feel here to give the comparative statistical study of cancer mortality and the general summary of the same which appeared recently in the pages of the *British Medical Journal*, which are given, seriatim.

That journal in its summary states:—"The definite conclusions of a positive character which appear to result from the present inquiry are:—

"1. That certain races are especially prone to cancer, more particularly the Scandinavian and the different branches of the Germanic family.

"2. That cancer is more prevalent in districts in which beer is the staple drink, and the excess is in some degree proportionate to the amount consumed per head.

"3. That cancer tends to cause excessive mortality in regions abounding in water, but to a much more marked extent when these are covered with woods or forests. The mortality is also usually high along the valley of rivers flowing from such districts.

"4. That the regional distribution of cancer indicates the probability that the disease is due to a specific cause."

With regard to the above points in the summary, there are a number of considerations regarding each which it is necessary to investigate:—

1. The Scandinavian races and the different branches of the Germanic family are probably more liable to cancer (*a*) because they are a fair-haired race; (*b*) beer-drinkers; (*c*) more liable to chronic infectious diseases of the type of phthisis, typhoid fever, and tubercular and scrofulous affections; (*d*) plethoric and full blooded or sanguineous; (*e*) other habits, which prevent the mothers from nourishing their children properly, for it is a well known and recognized fact that as a rule brunettes nurse their children better than blondes, as the milk supply is more abundant and of richer quality, but on the other hand the darker races of the European stock are more phlegmatic and bilious in their habit, and bile is Nature's antiseptic in the system.

In the case of animals, curious to say, "melanosis," which is a malignant disease in horses, generally attacks the white or grey horses in preference.

There are doubtless certain conditions present in the fair-haired races, the component parts of whose blood and tissues renders them probably more subject to "caseation" or "cheesy degeneration" in chronic inflammatory or infectious diseases, in which food and drink have probably a voice, if the principal elements (nitrogenous, carbohydrates, and hydrocarbons) are not in healthy proportion.

There seems a natural craving in the fair-haired races for stimulating and highly nutritious food to maintain the animal temperature, and in so indulging there is very often a tendency to excess, and if that excess be of poor material and disproportionate in its various constituents, there is a great deal of waste and work demanded of the organs, which ultimately resist and heap up the *materies morbi* through functional disturbance and want of organic co-ordination on the part of all the organs.

On the other hand, the dark races are hot-blooded, and do not require so much stimulating food; while instead of beer, they drink wines. The blood being richer in quality and corpuscles (red corpuscles), and the proportion of red and white corpuscles being perhaps better balanced, the process of oxygenation and phagocytosis is better maintained, and so either holds in abeyance or destroys the parasites or germs of cancer.

A hydræmic condition of the blood, which is found in blondes and in persons suffering from hydræmia or dropsical tendency, seems to favour the fermentative processes which form the necessary pabula.

Fair women suffer more from leucorrhœa than dark. Whether there is a disproportionate number of white corpuscles in their blood which brings about a condition of leucocythæmia, favouring cancerous and precancerous changes more than in dark women, is a question for investigation.

Then again, the fair races are found in countries where there is a deficiency of sunlight, and the vegetation of these regions is different from those countries where sunlight is abundant, hence the relation of the vegetable with the animal in the presence of defective sunlight and excessive moisture is most probably one of the necessary factors for cancerous changes, particularly if the blood and organs are inefficient for carrying away the *materies morbi*. In such conditions slow changes of a fermentative or putrefactive nature occur, which are aggravated at certain seasons of the year and influenced by sunlight, warmth, and moisture.

Sulphur, which is so very destructive to fungoid and all vegetable organisms, is more abundant in the fair and red-haired races, a provision probably of Nature's to meet the other deficiencies; but in its destructive property it probably does not enhance the removal of the effete products of its destruction by rapid oxidation, hence an accumulation of those materials which act as further irritants and foreign bodies, and so set up changes in the cells with growths.

Near intermarriage of the fair races might therefore still further enhance the necessary cancer factor and so the increase of cancer.

The adaptability of certain races and race peculiarities, together with close intermarriage in the inhabitants of various countries favouring cancer generation, is a subject therefore which is worthy of investigation; and the formulation of statistics is necessary, for purposes of a comparative study of cancer mortality.

With regard to nervous control in the fair races, doubtless there is great power and ability, for history shows their war-like characters, and one cannot help noticing the number of fair-haired soldiers in the United Kingdom and dominions beyond the seas, as com-

pared with dark-haired. But in considering this point, we must take also into consideration diseases such as Influenza which has been so prevalent of late years, and acts severely on the nervous system; also certain diseases of a chronic infectious type, which might act as predisposing causes to cancer by lessening vitality generally.

The winters in England, of late years, have not been so severe, whilst influenza has created severe ravages. These are conditions, which together with the strain and high pressure of living, must be considered in the causation of cancer. Excessive cold and heat seem, either to check, hold in abeyance, or kill the germs of cancer if long-continued. A moderate warmth with sunshine, encourages or renders active those germs which lie dormant or latent.

2. With regard to the second point in the general summary above mentioned, I have dealt already with the influence of alcohol and its consumption as beer or wine, its constituents or components, and the affect of this on the human body and its nutrition in moderation and excess. The balance of opinion seems to be in favour of either (beer or wine) taken in moderation for the healthy processes in our bodies; but a little more in favour of wines instead of malt liquors and champagnes, where the carbohydrates, or maltose and dextrose, are liable to set up changes which favour acidity and fermentation, and so destroy the digestive processes which are favourable to cancerous processes or the phenomena of cancer.

3. Regarding the third point in the summary, viz., water, woods, and forests, these seem to influence cancer development markedly, and the mortality is usually high along the valleys of rivers flowing from such districts. These are certainly points which tend again to show, what I have throughout contended, namely: the relation of vegetable and animal life to disease in every climate.

4. There are certain defects in our sanitary and hygienic conditions which are unrecognised as such; but at certain seasons of the year are influenced by the fresh showers of spring, and sunshine, and bring about a recrudescence of the "dormant" or "latent" germs of cancer; they then maintain their activity through summer, provided there be not excessive heat, and continue to grow in winter, provided the winter is not very severe. Spring, then, is the period of recrudescence or germination, summer for reproduction, and winter for growth of the parasites or germs (vegetable and animal).

The soil of certain districts where there are a number of cancer patients buried, contains the pabula for cancer development in greater richness, which pabula, are most suitable for parasitic life of cancer germs when entering the body of living hosts, then passing from host to host in their onward march, are carried to the lower animals and man, through ectophytic and entophytic, ectozoic and entozoic, parasites, which give rise to the parasitic protozoa, "mycetozoa" or "protomyxomycetes," above mentioned.

The overflowing of the banks of some of the rivers in certain districts, known as "cancer fields," is one of the necessary conditions for bringing the parasite to the surface of the soil in unusual numbers in the form of fungoid growths or "protomyxomycetes,"

probably through worms or larvæ of insects which find their way into certain houses known as "cancer haunted dwellings," and thus into the human body, through lower animal and insect life found in such dwellings.

Such forms of life exist either in the soil, or in the lowest vegetable and animal products of the same, as shown above, and it is through such, together with sanitary defects or flaws in certain houses, that a dwelling can be said to be "cancer infected" or "haunted."

In the above statement, we have an analogy as to the most suitable pabula for such germ life in certain species of polistes, and also the silkworms mentioned in connection with "muscardine" in Pasteur's experiments, where the decomposing tissues are more adapted than the living structure as nourishment or pabulum for the parasite or fungus.

Where certain benign cysts and tumours in the human body take on cancerous changes, in course of time there is an indication that such *materies morbi* are present which Nature attempts to remove or cut off from the human soil, by creating a growth, for such *materies morbi* do not attempt to attack living or healthy organisms, but dead tissues which have a lowered vitality and have taken on pathological changes, particularly at the "menopause" or middle period of life, when the most favourable conditions are present. Certain constitutions are affected more readily than others in this change, owing to habits, including the alcoholic, already mentioned.

The *materies morbi* can be easily transferred through the blood and lymphatics to parts of the body where the soil is more suitable, and where there are ready formed nests, through the action of ferments and acids, created by the above habits, on the mucoid tissues or protoplasmic molecules. By their presence, multiplication, overcrowding and hyperplasia an irritation is set up; and by the secretion or excretion of such germs or parasites, some highly organized ferment or acid is created, which readily decomposes the tissues setting up changes and growths which become malignant in certain cases, where the favourable conditions exist.

It will be found, that at the junction of skin and mucous membranes; at points where the greatest mechanical strain in physiological function of organs with mechanical action (which probably sets up microscopic lesions) exists; and where acid and alkalines meet, the highly organized chemical constituent or ferment conducive to cancer development and erosion of cells and tissues, is to be noticed. The microscopic lesions arrest fungi, moulds, and bacteria with epithelial cells which become transplanted and excite a growth, viz., the "protomyxomycetes," in the gradational scale. These create a chronic irritation, inflammation, and a further heaping up of cells which give rise to cancer development, and become identical almost with the normal structures of the part in their morphology. In some instances, insect bites might, as in malarial fever, transmit the *materies morbi* accidentally.

It is necessary not to lose sight here of what I have already mentioned before, regarding the pathology of disease in the vege-

table world, especially the nodules found in the roots of many "leguminosæ"; also what has been said concerning the "mycetophilidæ" (fungus eating flies) and the "cecidomyzidæ" and gall-gnats, together with the fungus of "Pityriasis versicolor" (chloasma) or "Microsporon furfur," which are identical, as stated by certain authorities, with the fungus of "thrush." Such skin diseases might be regarded as indicative of a liability to cancerous affection in the same way as "pityriasis" occurs in phthisical patients.

The fungus of thrush occurs in young infants mouths, when an excessive amount of mucus forms and turns acid. It also occurs in adults suffering from extreme exhaustion after a prolonged illness, typhoid fever, phthisis, and cancer.

One of the conditions which excites free flow of saliva in infants, is irregular or defective nourishment, or artificial feeding, which causes acidity (particularly in a confined room, due to CO_2) through fermentative changes. This excessive flow which turns acid, excites a larger flow still, since acids increase alkaline secretions, and the salivary secretion is alkaline. Nature endeavours to neutralize this excess of acid saliva by a still more abundant flow, which not only taxes the nervous system controlling the gland, but exhausts the gland. The excessive flow of saliva is also defective in composition when the large demand is created, and there is a *fermentable sugar* formed, which on coming into contact with the gastric juice, containing hydrochloric acid (HCl), in the stomach, forms "*galactose*," in the same manner as dilute mineral acid acting on "*lactose*" or milk sugar, also creates galactose. Lactose is directly fermentable with yeast. The dilute acid (HCl) is not in excess, and since acids check acid secretions, and the saliva formed is in excess and acid, it checks the excessive formation of HCl in the stomach.

In healthy persons, we are told, that the stomach contains "*sarcina ventriculi*," but in greater abundance in those whose stomachs are not healthy, but diseased. It seems to me it is one of those fungoid growths which, though found in the stomachs of healthy persons, acts as yeast in diseased conditions, causing changes favourable to ulcerations and growths in mucous membranes and tissues if suitable conditions be present.

Then again, when galactose is oxidised by means of nitric acid it yields an acid called "*mucic acid*" ($\text{C}_6\text{H}_{10}\text{O}_8$), which is only sparingly soluble in water, and is, in my opinion an irritant as well as a powerful solvent of the connective tissues when it enters cellular structures in combination with certain organisms, viz., the "*monadinæ*" and the "*nitromonas* of Winogradsky" which are active agents of nitrification, and enter the intestinal tract through external causes in the soil and the water which contains them, and is ingested or swallowed.

In the intestines of man and the lower animals, the "*monadinæ*" are found in *parasitic* form. They are also found in various parts of the alimentary canal and mouth with the "*vibriones*."

When we consider that many of the carbohydrates can be hydrolyzed like cane-sugar and form glucoses which are inverted by yeast and form alcohol slowly; and that acids are formed by

the ferments naturally present in the body, as well as those swallowed from the air (*Micrococcus salivarius septicus*) and water, which are often charged with such organisms, there is a butyric ferment created eventually from the lactic acid ferment, which acid, (butyric acid) is also derived from "fatty acids" and is conducive to certain parasitic growths in milk (*Micrococcus lactis viscosus*) and of the skin, possessing irritants of a peculiar character which cause various disturbances of a chemical and mechanical nature. We can understand that these fermentations might be considered precancerous states, and that our food, drink and habits have a very great voice in the production of diseases of the skin and internal organs, and our surroundings and locality also aid in providing, as well as in forming, certain ferments and pabula necessary for the carrying out of further changes. We cannot therefore be surprised that certain occupations in life, and habits (alcoholic), as well as geographical and local situations, must influence the production of those constituents which help to build up cancer products and growths in certain constitutions more readily than in others, and in a similar manner to the up-building of nodules in certain "*leguminosæ*" above mentioned.

Particular constitutions are capable of developing diseases such as phthisis and other chronic infectious diseases more readily if the chance work of infection comes in, and cancer must therefore follow the same law.

Why should the fungus of thrush, a disease of young infants, be present in phthisis, typhoid fever and cancer? Is it because of excessive acid mucus formation in the glands as the result of artificial feeding, or certain morbid nerve action on the glands? I am disposed to think that both conditions are possible causes. In some cases it is probably also due to regurgitation of gastric juice which contains HCl, or the ferments present in the air and water in localities abundant in particular forms of humblest vegetation and their spores taken into the system by inhalation or ingestion, and which cause this change by a hydrolyzing process or fermentative action on the carbohydrates.

We know how the soil, the water and the air, as well as the human body under supposed healthy conditions, are found charged with "*monas*," "*sarcinæ*," "*vibrios*" and "*cocci*," which act in the same manner as yeasts, causing inversion and producing alcohol slowly.

Later on, acid organisms form which give rise to "lactic acid," "butyric," "uræmic," "mucic," and "nucleic" changes; there is a process of nitrification set up attended with erosion and ulceration, in which "*monadinæ*" frequently may be found with "*vibriones*" to take an active part, causing by their irritation, (which is of a mechanical and chemical nature) distortion, dislocation and exuberance of cell growth; a heaping or building up, with an accumulation of the "*materies morbi*," through the destruction of balance between absorption and elimination in our system and the loss of nervous control and of lessened vitality generally at certain periods of life.

Such organisms as the "*monadinæ*" are also found in hay and straw, which is found mixed with stable manure and urine in a

pulverised state in the atmosphere; deposited on the leaves of various plants (terrestrial and aquatic); and in water. They can be carried by the forces of Nature to long distances as well as in the bodies of various insects (terrestrial and aquatic) to the lower animals and man, and when suitable conditions are present, they develop rapidly.

In the midst of large cities and manufacturing towns where smoke and sulphur abound through the burnt coal from fires, these growths have not same chance as in the country districts which are well wooded and watered, and where the influence of smoke and sulphur in destroying vegetable or vegeto-animal life is not felt to the same extent.

In certain districts, the conditions which can be well understood from what I have before mentioned are more suitable, and they find a better resting place, since the soil contains the necessary pabula, and certain dwellings also have the faults and flaws of sanitation and hygiene favouring such life as is productive of cancer in the presence of a certain degree of heat and moisture.

The drinking water system in such country places, particularly in the "cancer fields" where open air rain-water cisterns are in use, it is very necessary to protect from external contamination and pollution, and cisterns should be placed under cover, away from the action of sunlight. Filters also might be brought into more general use as a further precaution where such cisterns cannot be placed under cover.

Certain places which have reservoirs also, should be covered over with a protection from contamination with fine wire gauze, to prevent insects, &c., falling in. These are merely given as instructions in a general way. It is for the sanitary engineer and sanitary officers to devise the best system for protection.

XXII.

It is necessary to consider the composition of saliva and the salivary secretions in the first act of digestion next, in relation to the growths of the fungus of thrush and its appearance in chronic infectious diseases (phthisis, typhoid, cancer).

The constituents of saliva are:—Organic and Inorganic.

1. *Organic*:—

- (a) Mucin (precipitated by acetic acid).
- (b) Ptyalin (an amylolytic ferment).
- (c) Proteid (the nature of globulin).
- (d) Potassium sulphocyanide.

2. *Inorganic*:—

- (e) Sodium chloride (the most abundant salt).
- (f) Other salts (sodium carbonate, calcium phosphate and carbonate, magnesium phosphate, potassium chloride).

Among the above constituents, the chemical action of saliva in the process of digestion is due to its active principle "ptyalin," which is an unorganized ferment or enzyme, and belongs to the special class known as "amylolytic" (starch splitting) or "diastatic"

(resembling diastase, a ferment similar to that in which barley and other grains germinate).

Starch is first split into dextrine and maltose; the dextrin is subsequently converted into maltose.

Ptyalin also acts similarly on glycogen or animal starch or gum, but it has no action on cellulose, hence it does not act on uncooked starch grains, for in these the cellular layers are intact.

Ptyalin acts best at 35° to 40° C., which is the natural temperature of the body, and in a neutral medium. The other inorganic substances in saliva, help to maintain this neutral condition. Sodium chloride being the most abundant salt present, is found largely in the human body. It enables the circulation to occur freely, helping on those metabolic changes which sustain life and the balance of the system, by carrying off the effete products and preventing stagnation and decomposition of the blood. This salt, however, has to be in proper proportion in the body to carry on these changes, otherwise it is liable to create insalutary results.

A very small amount of acid stops the activity of the ptyalin, and so might saturation with sodium chloride, hence it is very essential that acids should not be permitted to form in the mouth in the first act of digestion, and a neutral medium maintained. The formation of acids, or their ingestion before meals particularly, is not only destructive to the principle of saliva (ptyalin), but interferes with the rest of the processes throughout the alimentary canal, which, if encouraged as a habit, soon set up those very changes mentioned which aid and abet cancer invasion by creating unhealthy products and fermentation followed by putrefactive changes and bacteria. These further prepare the soil for cancer by absorption, and act as ptomaines on the system, though slow and chronic in action.

If we consider the organic and inorganic constituents of saliva which the parotid, submaxillary and sublingual glands pour out through reflex action brought about by the nerve endings of the afferent and efferent or secretory nerves, together with the sympathetic, we can see that each of the solid constituents has a definite part to play in the first act of digestion. Anything which hinders the secretion of healthy saliva promotes fermentation and putrefaction, interfering with the rest of the processes of digestion through the stomach, duodenum, and intestines, in the same manner as a small quantity of acid interferes with and stops the activity of ptyalin in the mouth.

All habits which cause the secretion of acid saliva and acids in the mouth, or stop the activity of ptyalin and its chemical property must be checked or discouraged. Mental worry and anxiety, in my opinion, act through the nerves on the salivary glands, turning the secretion acid and irritative in the same way as anger and emotional effects alter the secretion of milk in a mother's breast, which, if the infant suckles at the time, creates diarrhoea and other changes. So that the nervous system is a powerful factor for good or evil in the matter of healthy digestion and disease. Alcoholic excess (especially beer, if it turns acid) or excessive smoking which excites a free flow of saliva, also give

rise to the formation of acids followed by "leucoplakia" ("leucoma," "psoriasis," "plaques opalines," "ichthyosis," "tylosis," and "keratosis"), which are precancerous formations in the mouth, gums and tongue. A foul pipe constantly used without cleaning is liable to produce similar changes. A warty form of "ichthyosis" has been drawn attention to by Mr. Hulke. These different terms used together with chronic superficial glossitis, are all probably early manifestations of cancer of the tongue, and must therefore be considered here in their relation to leucoplakia and leucocythæmia.

Sulphocyanide of potassium is present in saliva in small quantities, and can always be detected by adding a few drops of tincture ferri perchloridi to saliva, which turns pink or red. It is a very essential component or ingredient in the act of digestion, but is liable to fluctuation in amount and in strength. If present in normal proportion it undoubtedly must lessen the chances of acidity and the precancerous formations by checking early fermentation and putrefaction as well as fungoid growths in the alimentary tract. By rapid multiplication and reproduction of the fungoid or parasitic organisms there is a constant irritation set up. The analogy in action of the soil bacteria on the roots of "*leguminosæ*" by fixing the nitrogen of the air in a remarkable manner and so creating nodules, is one which might be here consistently applied to the formation of cancerous growths by the processes above mentioned, which occur in the human body when the general metabolic changes are altered through parasitic introduction and the changes occurring at the middle period of life.

This irritation referred to, is mentioned on page 15 of "Recent Essays by Various Authors on Bacteria in Relation to Disease," by W. Watson Cheyne, M.B., F.R.C.S., in dealing with "*Plasmodiophora brassicæ*," when this parasite fused itself with the protoplasm of the cell, so that at first, it could not be distinguished from the cell contents, but made its presence obvious a little later by characteristic changes in the cells. The plasmodiophora in vegetable life are equivalent to the "protomyxomycetes" or "mycetozoa" in animal life.

Woronin conjectured that many pathological growths and swellings which occur in the animal body owe their origin and development to a peculiar irritation, &c., set up by small "myxamœbæ" (cercomonads might be so termed, since they have been considered "amœbæ"), which, forcing their way into the animal tissues, develop into "*plasmodia*."* Eidam also confirms Woronin's observations, and considers it possible that the etiology of many hitherto unexplained infective diseases in which fruitless search had been made for bacteria, depends upon an invasion by parasites which cannot be distinguished from the tissue elements of the body, and behave in fact just as "*plasmodiophora*" do. These parasites belong to the class of "flagellate monads," and are most probably identical with "flagellated organisms," and have many features in common with motile organisms of vegetable origin; but they

* These are points I have already referred to in discussing the life-history of gordiaceæ and mermithidæ, as well as the cercomonads and insect life which harbour these parasites (both terrestrial and aquatic).

appeared to approach much more closely to "protozoa," more particularly several of the species of Dujardin's "cercomonas." They are regarded by many as "zoospores," but they seemed to be not unlike the flagellated parasite described by Bütschilii, which latter observer detected "flagellated organisms" ("Leptomonas Bütschilii") in the intestinal canal of a free nematode (*Trilobus gracilis*), which form stellate colonies like the "Surra" parasite. The destruction of these organisms is very necessary, since they give rise to ferments in the system which are capable of causing further irritation and growths.

From the clinical point of view, the "protozoa" and the "thallophyta" exhibit marked differences, for whereas the ill effects on their host produced by the animal forms are mainly due to the appropriation of the nutriment, to mechanical irritation and inflammation, or in a few cases to loss of blood from wounds inflicted by them, the results of the invasion of most of the vegetable organisms are rather of a toxic character, in this way determining the specific infective diseases. (In cancerous growths, these two forms of life are acting in unison and thus give rise to the "protomyxomycetes" or "mycetozoa").

"Tinea versicolor" is a disease which occurs in middle-aged people and those predisposed to phthisis; it occurs in the chest and shoulders, and as a rule in persons who perspire freely, and may be regarded as a pre-phthysical condition; while "leukoplakia" of the mouth and the *warty form* of "ichthyosis," also known by other names, is a precancerous or early manifestation of cancer of the tongue. It is not a little remarkable that the fungus of "*tinea versicolor*" and "*thrush*" are considered to be identical by some authorities. In patients suffering from "tinea versicolor" there is a rancid odour of cheese given off from the body and the undergarments showing that butyric fermentation is the cause. The fungus adheres closely to the skin and clothes, and attacks the hair follicles whence it starts and spreads slowly to join other spots involving the skin over an extensive area, doubtless striking its roots deeper. The dermoid forms of cancer and the precancerous changes are probably started by a similar process which shows that the soil is prepared.

In carcinoma of the breast, there is present as pointed out by Paget in 1874, an eczema or ulceration of the nipple. This form of eczema of the nipple may exist and get well without giving rise to cancer, and likewise the formation of a cancerous tumour after existence of the nipple trouble for a long time previous—the work of chance cure, similar to the work of chance origin—in some cases the eruption presented, we are told, the character of an ordinary "chronic eczema" or "psoriasis," the eruption spreading beyond the areola in widening circles or scattered blotches of redness covering nearly the whole breast. This eruption has defied all treatment both local and general, and has continued even after the affected part of the skin has been involved in the cancerous disease.

Butlin has described, in addition to this, some histological formation, and has shown how he believes that carcinoma follows the nipple affection, and has traced the changes into the mouths of the

galactophorous ducts, and shown how the spheroidal cell is substituted for the columnar cell which naturally prevails there. This condition has continued deep down into the substance of the mammary gland where the sacs become similarly affected.

Subsequent changes are also mentioned in the connective tissue, and also coincident with those in the ducts and glandular epithelium which are most interesting.

Dr. Thin was opposed to this form of skin affection being an eczema, and from his observations and examinations concludes that this "malignant dermatitis" is a secondary eczematous condition following the cancerous change in or near the mouths of the ducts. The fluid which escapes from the mouth of the ducts acts on the connective tissue and possesses the *corrosive qualities* of cancerous epithelium.

Dr. Munro was also of opinion that the primary sac was "malignant disease" from the very commencement.

Dr. Duhring was also of opinion that the disease is not an eczema, but that it is a peculiar disease with a malignant tendency.

In some respects this affection of the nipple resembles "pityriasis rubra," resembling "lichen ruber," "eczema," and "pemphigus foliaceus." "Pityriasis rubra" is a chronic disease as a rule, but occasionally acute. Patients may recover or the disease may end fatally.

In all the above points I am fully supported in the various alterations of a bacterio-chemical nature which occur and which can be traced to certain habits, bad hygienic conditions, as well as sanitary defects in the water supply in "cancer fields" chiefly, and which are connected, giving rise to parasites introduced accidentally into the human body in particular ways and through particular kinds of food.

XXIII.

The Relation of Putrefaction to Fermentation and Cancer.—Putrefaction, according to Curtis, is a term used to cover a series of changes similar to those of fermentation, by which complex organic bodies are reduced to simpler chemical substances. Changes, which in the case of putrefaction, occur after life has become extinct.

Putrefaction has been defined as "putrid fermentation," or the "fermentation of dead organic matter."

I have before mentioned, that infusoria live in putrefying substances, and are often found in countless numbers in water, or in the rectum of living animals.

Special attention has been drawn to the "monadinæ" by certain authorities on bacteriology. Their presence in invertebrates and vertebrates, and their parasitic condition in man, particularly in certain cases of dyspepsia, diarrhœa, and ulcers; and their presence in certain regions away from their normal "habitat" in man's body, *i.e.*, travelling from the intestine to the liver through the bile ducts, speak clearly of their powers of migration to distant

tissues, and also their powers of penetration to the interior of foreign growths such as benign tumours and the echinococcus cysts. The opinion of Woronin regarding the "myxamœbæ" has already been stated, as well as that of Eidam, who confirms Woronin, with regard to certain pathological swellings and growths owing their origin to a peculiar irritation set up by small "myxamœbæ," which force their way into the animal tissues and develop into "plasmodia." These organisms have been called "flagellated organisms" ("protomyxomyces" by Cunningham), and are likened by Lewis and others to the "cercomonas" of Dujardin. They cannot be distinguished at times from the tissue elements of the body, and behave as "*plasmodiophora brassicæ*" do, fusing themselves with the protoplasm of the normal cells, so that they could not be distinguished from the cell contents till later on.

The "monadinæ" are therefore gifted with peculiar powers in the midst of slimy fluid, and are associated frequently with "vibriones." The "vibriones" are probably members of the vegetable world, and stand in correlation to putrefactive decomposition in their growth, as the development of the yeast plant is an act correlative to alcoholic fermentation.

"*Cercomonas intestinalis*" has been observed in various intestinal diseases, and mucus masses supply a favourite breeding place. They have also been observed to be present in the intestine of individuals who have all suffered for years from dyspepsia and diarrhœa, and also in the mouth among the fur covering the tongue in a case of carcinoma of the stomach, so that their presence is one of very great significance as one of the precancerous conditions, for the reasons already given, when present in the human body in cancer.

I have observed these organisms in a case of epithelioma of the mucus surface covering the alveolar process of the lower jaw and buccal mucous membrane, in a patient who had originally an epithelial cancer of the left half of the tongue which was operated on by a London surgeon. The growth reappeared after about seven years in the adjoining left half of the mucus surface covering the lower jaw, which was removed by a second operation in London; but it reappeared within a year, when he came to consult me. On scraping the surface of the tumour with a small scoop, I brought away a good deal of epithelial covering.

On examination of the same under $\frac{1}{12}$ oil immersion, distorted epithelium of various forms, the fungus peculiar to thrush ("oidium albicans"), and peculiar club-shaped cell-like masses with a faint nucleus of a large size, were observed. I now placed some of this scraping into dilute glycothymoline for a few seconds, and on examination, found that these club-shaped cell-like masses separated and again became attached, once more separated and then became attached. To bring them more clearly into view, and to show their dovetailing which one might have mistaken for a membrane at first when fused together, I placed some tincture of iodine on the slide under the cover-glass, and on observation, the club-shaped cell-like masses turned a dark yellow colour with the nucleus large and distinct and of darker brownish-yellow tint. The glycothymoline was dilute and non-irritating.

One cannot be surprised at these bodies getting into the alimen-

tary canal of man since they are found associated with the urine of animals, and are by no means rare even in the fresh urine of horses (Leuwenhoek). But in intermingled organic substances, they are found to exist largely. Considering that stable manure in pulverized form is the chief constituent in the dust of London air, according to the analysis of the Honourable Rollo Russell, we can well understand how the proverbial peck of dust swallowed in our travels, makes it possible to ingest these minute organisms, which might also be inoculated through the bites of insects occasionally in the face (creating rodent ulcer), producing a lesion, into which, if these organisms accidentally enter, they are capable of creating changes and being further introduced into fresh hosts. The summer months would be more favourable than winter.

Moreover, the "*cercomonas muscæ*" is found in abundance in the chylic stomach of the house-fly, whose visits, in the summer to our parlours and kitchens, scatter seeds of minute germs over our food and drink as well as over the window panes and walls of houses where they eventually die surrounded by a fungoid growth ("*empusca muscæ*") which eventually kills the fly in autumn. "*Empusca muscæ*" belongs to the mould fungi and "*hypodermii*" order of the same (the other orders are phyco- asco- basideo- and myxomycetes).

Flies as a rule are found in abundance over dung-heaps, and probably carry away a host of "monads" from the intermingled organic substances, and then develop in the chylic stomach where an irritant secretion of a fermenting character forms which gives rise to toruloid cells which kill the fly eventually. In the same manner, the "mycëtozoa" in cancer give rise to an irritant secretion under certain conditions, which form new growths and kill.

I think that we must recognize the strong connection between the "monadinæ" and cancerous growths through the forms of life created which form ferments and irritants, and an infection of the human body, either direct or indirect, which prepares the blood for further changes. These changes probably occur through inoculation by insects such as the fly, beetles, "*simulidæ*," &c., which bear the *monads* which enter the system and are capable of forming "plasmodia," which arise through the "myxamœbæ" forcing their way into the animal tissues where they develop. Whilst the "*cercomonas muscæ*" is a stage in the development of the "flagellated organism" in the chylic stomach of the house-fly, which enters the tissues and meets the "plasmodia," which on impregnation multiply and reproduce cells which fuse with the natural cells of the tissues of the part, and are difficult to distinguish as distinct parasites unless the process above described is carried out.

The horse and dog, man's favourite friends and companions, are also capable of carrying certain insects in their bodies which are able also to transfer the parasite to man's blood and tissues. Dogs are in constant touch with horses in the stables, and with man, and bear fleas and the dog-louse in their bodies which carry worms in their bodies, and are also capable of doing mischief through their bites, by transmitting the germs of cancer through inoculation, in

the manner described, which, like all other parasitic transmissions, is *accidental*, as a rule.

The "infusoria" are regarded as a larval stage of a higher organism, whilst the "flagellata" are regarded by Cunningham as developmental stages in the life-history of a "myxomycete" or "myxamœba."

Dr. Hicks, moreover, is of opinion that the "protoplasmic contents" of the roots of mosses become converted into minute "ciliated" bodies, which lie in a borderland between the amœboid body and the "protozoa," which are the "protomyxomycetes."

Almost all the "infusoria" live in putrefying substances, and are found in countless numbers in water or in the rectum, especially of living animals.

The most familiar types of these are found in myriads, in the large intestine of frogs and toads. In warm-blooded animals they are also among the most frequent of parasites.

The "infusoria," according to Leuckart, are generally divided into the "flagellata" and "ciliata." Special attention is, however, to be given to the "monadinæ."

The parasitism of the "monadinæ" is by no means exclusively confined to the vertebrata. In the genital canals of snails and molluscs, the body cavity of rotifera, as well as the alimentary canal of millipedes and insects, they are not at all uncommon; and they are occasionally seen to fill whole tracts of the intestines in flies and moths.

Dallinger and Drysdale have observed "conjugation" in the "monadinæ." This is followed by "encystation" in which the contents break up and become movable germs or countless immeasurably small spores which afterwards become "monadinæ." Cunningham regards the parasitic forms as "swarming conditions of amœbæ."

The "cercomonas" are said after encapsulation to become "amœbæ," which fuse together in large numbers after losing their power of movement, and form considerable masses or even "sporangia."

The "monadinæ" occur in man and are not rare. They are very sensitive to the weakest solution of corrosive sublimate, a point of very great importance to note, since their destruction is doubtless necessary in ulcerative and cancerous affections.

The "cercomonas" and "trichomonas" are worthy of careful investigation and study. "Cercomonas muscæ" represents a parasite found often in abundance in the chylic stomach of the house-fly, and also "trichomonas batrachorum" from the cloaca of the frog. These have been confused with one another more than once. There occurs another form hardly distinguishable from the latter, viz., "hexamita." "Cercomonas," "bodo," and "monas" are found in sea-water, and all these genera contain forms said to occur in man, and according to Steinberg, in the white substance often found between the teeth in the human being.

"Monas crepusculum" and "bodo saltans" occur often in great numbers in unhealthy ulcers, and are doubtless particular forms of parasitic organs which bear some relation to the different types of cancer.

Monads should only *rarely* be found in *normal* human urine, and it is only in *intermingled organic substances* which make the existence of these parasites possible. But as such admixtures are more frequently found in the urine of animals (as Leuwenhoek has shown in the case of the horse) the presence of these creatures is by no means rare in fresh urine. One cannot be surprised to find "monads" in abundance attached to fragments of hay and straw in the streets, stables, houses, and in the open rain-water cisterns and reservoirs, coming into contact with the surface of the human skin and mucous membranes and then being swallowed. Their irritant action might be well conceived in some constitutions whose skins are sensitive and perspire freely, when fermentative changes of a butyric acid character readily form and intermingle with such substances as are deposited on the body, creating a ferment or growth which is absorbed readily through the hair follicles, and becomes a source of great irritation when a suitable opportunity occurs.

"*Cercomonas intestinalis*," parasitic in man, is frequently found in the stools of patients suffering from acute and chronic diarrhoea, and in dysentery also.

Lambl found it in myriads in the jelly-like substance in intestinal mucus, and again a form of the same parasite which could not be distinguished from "*C. hominis*" in the liver. The person infected was suffering from "echinococcus" and died from the potassa caustica treatment. A post-mortem examination was made twelve hours after, and a large echinococcus cyst was found, and apparently from a widened and degenerated bile-duct containing a slimy fluid in which were "vibriones" of diverse sizes and a countless number of cercomonas. The fluid in which these were found showed them to possess an extremely quick, but very variable motion, and sometimes grouped together in dozens around a common centre. They also varied in form according to the contraction of the body, but were generally elliptical or spindle-shaped, sometimes pear-shaped or cylindrical.

Besides some strongly retracting granules, two pulsating vacuoles could be distinguished in the hyaline parenchyma posteriorly. A division was also observed, both in the "motile" forms and in those which had contracted into a ball and lost apparently both "flagellum" and tail. Finally the twin forms are connected together only by a fine thread which has been regarded as a "flagellum."

In the above case, the cercomonas were found exclusively confined to the echinococcus sac, not a trace of them being found in the intestine.

Their reproduction in countless numbers in the above sac speaks for such powers as they possess. The cercomonas penetrated the liver from the intestine undoubtedly, and this took place at the commencement of the echinococcus disease five years previously as the medical history would show. Their appearance in the echinococcus cyst when they became encapsuled, and not in the intestine where they formerly lodged, inclines one to conclude, that they can only be regarded as the last survivors of a previous intestinal disease.

The case here cited, is not, we are told, the only one of the kind, and is therefore of great interest in cancerous and precancerous changes which lead to malignancy through such organisms and their secretions which act as ferments.

The cases observed by others of *cercomonas* in the intestine, occurred in individuals who had all suffered for years from dyspepsia and diarrhœa, two not very uncommon symptoms in cancer of the stomach (duodenal) and of the intestine. The stools were peculiar, pulpy, and toughish in character, with a heavy putrid smell which probably arose from the presence of mucus in masses.

The "*cercomonas*" never seems to occur in the ordinary forms of diarrhœa or in normal stools.

The presence of these parasites has a certain connection with intestinal disease. An increased number of them aggravated the symptoms. Mucus masses supply a favourable breeding place for the parasites as similarly observed in "*bodo urinarius*." They sometimes promote their increase to such an extent, that they become a decided irritant, and thus tend to aggravate the disease which assumes a malignant type through loss of vitality and of nervous control in middle life.

Zunker observed this parasite, we are told, in a case of carcinoma of the stomach, even in the mouth among the fur covering the tongue; but in pulpy stools only a few specimens could be found.

"*Trichomonas* *Donné*" have been found in a parasitic monad living in the human vaginal mucus ("*T. vaginalis*"). Dujardin discovered one in the intestine of a field slug ("*T. limacis*"). Other species have been added, and all are parasitic and indeed intestinal parasites.

They occur both in the invertebrata and in the vertebrata, both in cold-blooded and warm-blooded animals, and especially in mammals.

The "*T. vaginalis*" is extremely sensitive to water, and generally perishes quickly after applications of such kinds. They then swell up and coagulate into a more or less globular mass—motionless and robbed of its appendages.

This resemblance to ciliated cells gave rise to the widely spread opinion that the *trichomonas* of *Donné* represented only "isolated and altered ciliated cells."

"*T. intestinalis*" has a strong resemblance to "*T. vaginalis*." These parasites are likely to be confounded with "*cercomonas*" if not carefully examined. They are possessed of great contractility, so that the form of the body is changed in an almost amœboid manner. When death approaches they sink motionless, lose their ciliary comb and assume a round shape.

Trichomonas occurred in acute cases of typhus, peritonitis, in severe diarrhœa, complicated with icterus and pneumonia, as well as chronic ailments (generally diarrhœaic). They were also sometimes found in the human mouth. Sternberg mentions three species in the dental deposit in men, viz., "*T. elongata*," "*T. candata*," "*T. flagellata*."

The ciliata.—This order contains the larger infusorians with respect to which what has been stated previously applies here.

This order, as well as the family "bursarieæ," are also worthy of study as to their form, reproduction, multiplication and effects when present in large numbers in the intestines, as well as in ulcers, when a severe irritation is set up which must create serious changes in the part when present, creating a form of malignancy.

These points have been brought forward to accentuate the importance of those forms of life to cancerous growths.

XXIV.

Malaria and Cancer.—Cancer in many points might be said to bear a resemblance in its origin and results to malarial fever. It is necessary therefore to note the conditions and causes of the latter.

In India, it is the low lying flooded districts with a clayey soil in which malarial fever breaks out at the beginning of the rainy season, when there is a recrudescence, and again, after the rains have set in and closed.

A small rainfall, and a certain degree of heat and moisture, brings about a recrudescence of malarial fever; while insect life (mosquitoes) is once more seen to appear.

A large rainfall at the beginning of the rainy season seems to dilute the poison and carry away whatever might be on the surface of the soil in a "latent" form into the pools and streams.

During the height of the rainy season, malarial fever is not so rampant; but after the rains, when the country around has been flooded, and the drying process through the scorching rays of the sun has begun, malarial fever breaks out at its worst, becoming intensified till the end of October; sometimes till the end of November, in some parts of India. Insect life has done its work by now, and mosquitoes have begun to disappear and die; but malarial fever lives on in the blood and awaits an explosive cause.

There are exceptions regarding the best geological formations where malaria occurs. For instance, in Tura (Garó Hills), Assam, which is about 1,300 feet above sea-level, surrounded by sub-montane tracts where malaria abounds, malarial fever, curious to say, occurs in a most intensified form. Here, "kala-azar" or black fever, which is an intensified form of malarial fever, occurs, and this place is said to be the home of the disease. There is a great deal of limestone and chalk formation here, but not much clay. There is dense vegetation and an abundance of water which has a peculiar greasy feel and slightly pungent taste. The atmosphere is hot and steamy with a suffocating feeling which is almost stifling at times; while mosquito life is fairly prolific.

The hill above Tura is about 3,000 feet high, and faces the low lying district of Mymensingh to the south and south-west, from which hot blasts of air come sweeping up the hill slopes; while to the north and north-west, the town of Tura is fairly shut out, except through a dark narrow gorge from which chilly blasts come rolling down the hill and enter the Europeans' houses at sunset and at night.

A change of air at 1,800 to 3,000 feet above sea-level, though beneficial to a malarial patient *by removing anæmia*, is not altogether sufficient, nor is it so lasting in its effects as a change to a higher elevation varying from 5,000 feet upwards.

At Tura, the health of the European inhabitants is always below par, and anæmia with entozoa and skin diseases is rife. The Native inhabitants also suffer, and the Garo people have a form of leucoma or white skin, with bony formations or lumps like "yaws" over the hips, which look like tumours.

I do not think we have quite fathomed yet the cause of the different forms of malarial fever and their complications, in which the mosquito might be regarded as a vehicle or channel of transmission of the poison, and a means of manufacturing the extra-corporeal life or stage of the parasitic growth by ingesting the "crescent bodies" before infecting a fresh host.

Regarding the "*plasmodium malarix*" in malarial fever, we are told, that it might be taken into the system through contaminated drinking water, and also in a "latent phase," although the latter has not yet been demonstrated.

As to the origin of the "crescent bodies" which have been demonstrated in the human blood, we have not yet been shown how these peculiar bodies arise, nor has much light been thrown on the origin of the bodies known as the "primitive bodies" of Plehn, "speckled corpuscles," or "karyochromatophile granules." It is very necessary to know what such bodies are before we can tell of the origin of others which subsequently appear in the human blood, since these "primitive bodies" are observed in the blood of "*non-malarial*" as well as "*malarial*" Europeans in West Africa when they *first* arrive in the country *previous* to an attack of malarial fever, *though accompanied with anæmia*. We are told—they are supposed to constitute the "latent phase" of the parasite of malaria in the blood.

Whether they are considered a "latent" phase or not, the question is, whence do they first enter the blood? From the soil, the air, the water, food, or where? The fact that they are accompanied with anæmia in the Tropics is suggestive of an entozoic origin. Entozoa are clothed internally with entophytic fungi, and these bodies find entozoa the suitable hosts for entry in this particular form for transmission to man and the lower animals assuming the stage of a "mycetozoon" or "protomyxomyces."

This form of life, according to Cunningham, is a stage between the fungi and the protophyta, and the amœboid or protozoa, the host of the parasite being a worm in whose interior it is developed.

It is necessary to note, that the presence of the "primitive bodies" in Europeans in West Africa, is, *previous* to an attack of malarial fever, *accompanied with anæmia*. The anæmia is probably a preparation of the soil before malarial fever pronounces itself. This is a common condition to be observed in India where malarial fever in its worst forms prevail.

Skin diseases and entozoa are also to be noticed as common accompaniments of malarial fever attended with anæmia, so that it is most probable, that the origin of the "primitive bodies"

is from helminths and entozoa introduced into the human body, and that they belong to the "protomyxomyces" prior to the other stages in their development to "protozoa" which give rise to the "plasmodium malarie."

This stage in persons residing in the Tropics predisposed to malarial fever, might be said to be analogous to the "still" condition, in unicellular plant life ("Palmagloea macrococca"), and from this "still" condition, that remarkable "motile" condition arises which is seen in the life-history of another humble plant, the "protococcus pluvialis" which might be said to begin in the "still" form of cell which was supposed to betoken animal life.

Carpenter tells of a phenomenon in the "cell contents" in the "still" form which subdivides into eight portions, being of small size and endowed with "motile" power, and are designated "zoospores." He also tells of the conversion of an ordinary vegetable cell into a free moving mass of protoplasm in "volvox" which bears a very strong resemblance to the animal amoeba."

In nature, we find everywhere that the vegetable and the animal are always closely associated with one another, and eventually fuse into each other; one cannot therefore afford to neglect this fact, and that they are closely associated in disease also. These in their combination, give rise to the "protomyxomycetes" or "mycetozoa," which have a wonderful faculty of adapting themselves to their environments (aërobic or anaërobic); to the still, the motile or flagellated stage of existence akin to "protozoa" which they ultimately claim relationship to, by throwing off allegiance to the "protophyta" in the gradational scale.

The "primitive bodies" might be regarded in a sense the advance guard, or emissaries of malarial fever in a "latent form," preparing the soil for further developments.

It seems natural to suppose that entozoa are the hosts in the evolution of that form of life between the vegetable and the animal, the one creating the wound or lesion, the other acting as the enzyme or toxin, and the two in combination, giving rise to the "protomyxomyces" which defy detection when fused with the normal cells of the part—a form of mimicry as it were, which creates a growth or nest ultimately when conditions are favourable in the part.

The "primitive bodies" seem capable of creating the "plasmodia" of malarial fever, by a process of subdivision similar to that in the "still" condition of the humblest plant life.

By a process of binary subdivision they are capable of forming the "syzygium" of Mannaberg, which is a binary subdivision of the "motile" cell derived from the "still" cell.

The "crescent body" might, I think, be considered a derivative of the "primitive body" analogous to the higher stage known as the "encapsuled" or "cystic" stage in entozoa and helminths. It enters a red corpuscle for a double purpose, viz., to seek protection from the attacks of the phagocytes or leucocytes and also for the purpose of convenient transmission in the next stage to the mosquito; namely, the "flagellated body," which on fresh infection of a new host during the act of transmission, exflagellates when the mosquito bites, when the "flagella" are set free and attach them-

selves to the free "plasmodia" so abundantly formed from the "primitive body," impregnating them, and forming the "crescent bodies."

Such "plasmodia" as do not form "crescent bodies," go on dividing and subdividing into "secondary plasmodia," and are either in the end destroyed by the phagocytes, or perish through weakness or want of sustenance, if the person in whose blood they exist removes from the surroundings of climate and locality, or undergoes proper treatment.

Those who have had experience in the treatment of malaria in India, will tell you, that there is a technique to be followed; first, a purgative is very necessary prior to the quinine treatment, and unless the bowels are cleared, the full effect of quinine is not witnessed. Why is this? Because the "primæ viæ," in which entozoa and lumps of mucus lodge, supply the pabulum and the "primitive bodies" to the malarial infected blood, and unless the cause be removed, the effect of quinine *alone* is only temporary. It will also be found necessary to give iron in some form as a tonic after the action of quinine; first, to prevent the formation of abundant mucus and entozoa; and second, to improve the blood and oxygenation of the tissues and organs, and so re-establish the broken down constitution, and remove anæmia.

What is the best purgative in such a case? We are told by some, preparations of mercury. Why? To act on the liver, and its action is necessary for the secretion of bile, which is a natural purgative and antiseptic of the human intestine. I can say most confidently, and from experience, that castor-oil emulsion with oleum menthæ piperitæ is the safest and best for children and also in cases where there is no hepatic mischief. To prevent severe griping, a few drops of brandy or chlorodyne are necessary. Its action is not merely purgative, but if entozoa are present, it envelops them and clogs their breathing apparatus and thus prevents further mischief; the peppermint oil also aids. In some bad cases, it is necessary to repeat the oil on the third day to ensure complete action and expel all mucus. In dysenteric complications from malaria, castor-oil and liquor hydrargyri perchloridi are useful at the outset of an acute attack before the administration of other specific remedies for dysentery.

In malarial fever, I am firmly of opinion that castor oil and peppermint in combination, and made into an emulsion with liquor potassæ, are cleansers and purifiers of the blood by carrying away the effete materials, and by depriving the blood of further supplies of such through the chyle which is badly elaborated.

It is worthy of mention here, that in acute fevers in the Tropics, there is a tendency for boils and abscesses to form; but in temperate regions where chronic infectious diseases are present, and gain a firm hold on the system, there is either chronic supuration with caseation, and tumours or new growths.

Anæmia and leucocythemia are very important premalarial and precancerous stages in malaria and cancer respectively. They lead to degenerative blood changes and leucocythemia, destroying the power of the phagocytes if they become pronounced. This is due to the destruction of hæmoglobin in the red corpuscles, and then

the process of oxygenation is lost to the system, leading to hydræmia and fermentative changes in which abundance of impure water and food act as further pabula, and keep up hydrolysis. If the patient be not removed from such surroundings early, hurtful conditions ensue; cachexia sets in, which is then most difficult to combat with, since the organs have lost their physiological and co-ordinative action, and cannot come to the rescue, since the blood stream is impregnated, and has lost its power of recuperating the system, by the conversion of the hæmoglobin into melanin. We then have the intensified form of malarial fever, such as "kala-azar," which is largely associated with "ankylostomum duodenale." If we apply these processes to cancer, and its development from chronic infectious disease, from the simpler forms to the melanotic, we see their analogy in the processes at work through the blood, organs and tissues, as well as those other changes witnessed in the "leguminosæ" which create nodules, together with the other chemical changes.

The "primitive bodies" have therefore, a great variety of functions to perform in the human blood, by first creating anæmia and leucocythemia, which prepare the soil for further changes.

As in man's blood, so in that of the lower animals, similar developmental stages take place, in which insect life which frequents the various animals and inflicts bites, are necessary for the extra-corporeal or extra-corpuscular stage, and there are particular forms of parasites for each type of cancer.

It has been affirmed that Delhi sore, above described, protects man from malarial fever of the worst types. If such be the case, there being a similarity in "bursatee" and "rodent cancer" to the above sore, it would be interesting to investigate whether "rodent cancer" and "bursatee" protect man and the horse from malignant tumours of a worse type. If this is the case, then, we have in the serum of these affections, a ready method of serum-therapy for cancerous growths, and treatment which might lead to further discoveries in the treatment of the different forms of cancer.

As there are certain laws governing the multiplication and generation of the humblest plant and animal life, so there are doubtless laws which preside over the evolution of a disease like cancer.

As there is *conjugation* in the "still" forms of plant life, and *binary subdivision* in the "motile" forms, so we might presumably infer, that the same occurs in the development of parasitic diseases of a fungoid, protophytic, or the protozoal and mixed forms, which invade the blood, tissues, and organs, under suitable conditions; it is these stages which are not yet recognizable accurately under the microscope, since so little is yet known of the sub-kingdom "protozoa," and the class "infusoria," as well as the "mycetozoa" or "protomyxomycetes" of Cunningham, and the "hæmatozoa" of Lewis.

XXV.

Summary.—From the above description of malaria, and the changes or stages in humble plant and animal life, together with

the strong analogy which exists between the disease malaria and cancer, as well as the conditions of life in tropical and temperate regions respectively, we cannot but conclude that age, sex, climate and season of year, exercise and sedentary habits, as well as alcohol and food, with other habits which predispose to chronic infectious diseases, clothing, temperature, air, water, woods, locality, race, geographical, and other conditions, all enter into the question of cancerous formations and development. All these conditions influence the blood, tissues, and organs, and tend either to promote or injure the health of the individual in course of time.

Our companions and friends among the lower animals, together with parasitic and insect life harboured in their bodies, as well as free insect life in our surroundings, might be considered *accessories* or *vehicles* for the transmission of the germs of cancer which undergo changes in the stages of development, setting up fermentative processes in which the humblest forms of plant and animal life in microscopic form once more enter those tissues which are predisposed and readily reached, such as the skin and mucous membranes, where mixed forms of life now do their work, and set up chemical alterations and conditions which favour new growths (*vide* "The Etiology of New Growths," in the *British Medical Journal* of June 27, 1903, p. 1484, by Keith W. Monsarrat, M.B., F.R.C.S.).

In considering, therefore, the life-history of cancer, circumstances point strongly to an analogy with malaria—the one, a disease or growth, which is creating a high mortality in temperate regions of the globe among a people living under western standards of civilization, which defer acute changes, or rather chronic infectious diseases, which set up growths. These conditions are brought about largely by climate and habits, such as the omnivorous or carnivorous indulge in; and also through flaws and defects in sanitation and hygiene which favour slow parasitic changes in the presence of alcohol, or the alcoholic habit. There is some excuse perhaps to be made for the habits, since man has to maintain a certain animal heat to perform the functions of life in a temperate region, without which, the machinery of the body must cease to act, since the stress and strain of life demand rapid stimulation. But if with these habits the *materies morbi* are not periodically removed, in the same manner as a mechanic removes the oil which is mixed up with dirt and dust in a machine, by putting in fresh and sweet material in its place, we cannot expect the machinery to last long, and move easily. This is not the case with the individual only, but with a race and a nation. We've got to move, and the clogging must be also removed; but at the same time we've got to rest. If the heart be taken as an example of perpetual rest and work, we shall see that work and rest are intended to be equally balanced. Assimilation, absorption and elimination, are the processes at work in digestion with the conversion of all material, food and drink taken into our system, into a force for the maintenance of life. If these are properly carried on, the constitution is built up strong and able to resist all the elements, and to create longevity. If

improperly done, the consequences rest with us to endeavour to remove. But if the medical profession are to do their work in this grand plan of prevention of disease, its cure and treatment, as well as the promotion of longevity, they must be properly represented, and their members given the wherewithal to do this great work in the world's economy.

The other is a fever (malarial fever), under a tropical or sub-tropical sun, which kills millions yearly, and occurs among a people, whose mode of life and habits are chiefly vegetarian (though somewhat omnivorous or carnivorous among a small section), under an eastern standard of civilization.

One hears it declared frequently, that the natives of India are attacked less with malarial fever than Europeans. If such were really the case, we should not hear of the numerous instances of enlarged spleen and the high mortality from malarial fever annually. A malarial diathesis might prevent the more virulent types of malarial fever, and the serious complications of organs.

The vegetarian is more liable to acute fevers, such as malarial fever and complications, since his blood has not the same vitality and resisting power as that of the European as a rule.

The result of strong power of resistance is either acute abscesses or compensatory hypertrophy, and in the end, a growth as the result of chronic irritation. Malignancy follows as the result of pressure and overcrowding, with heaping up of bad materials or the *materies morbi* which undergo fermentative and putrefactive changes. Sthenic and asthenic inflammations are the phenomena to be taken into account when the physiological balance is disturbed, and disease takes the place of the healthy constitution; but the results of these phenomena depend on external and internal exciting causes, as well as the pabulum supplied from day to day. "As thy day so shall thy strength be."

In India, one sees a great deal of malarial fever in various degrees and types, among people who are vegetarians; but very little cancer, except among those who are not pure vegetarians, as I have mentioned before. In cancer, an omnivorous or carnivorous host seems necessary for the introduction of the parasite and subsequent changes.

In Europe, generally, there is very little malarial fever (except in Holland and parts of Italy, and in few countries); but an abundance of cancer and tumours of various kinds, benign and malignant.

The occurrence of these respective diseases in tropical and temperate regions, is doubtless due to climate, race peculiarities and habits. Food and drink must enter into consideration in their respective prevalence in these regions.

In India the sanitation is largely effected by the forces of Nature in the open air under the fierce sunlight; in Europe it is through subterranean sewers, away from the deodorizing and disinfecting powers of the sun.

Fish and shellfish, aquatic insects and rats, live on sewage and its products teeming with organisms of decomposition.

When rivers overflow their banks in the "cancer fields," these

channels of infection are rendered patent in districts and places where cancer mortality is highest.

Subsoil drainage, during such periods, brings the *materies morbi* to the surface in the "cancer fields," and these are carried away by insects and animals, or driven by winds when the drying up of the soil occurs, and so find their way eventually into man's dwelling and body, as well as into the bodies of animals feeding on the pasturage of such countries. The existence of abundant water in such cancer fields, is a channel for continual action through subsoil drainage; whilst the luxuriance of woods and forests is a means for the manuring and upkeep of materials for such a manifestation—these are the factors present when cancer occurs.

The food of the infected animals, viz., sheep, oxen and pig, which graze over such land, is ingested by man, as well as by some of the lower animals (dogs, cats, &c.).

During a fresh fall of rain, and with the fresh showers of spring, many of the lowest types of parasites and animalcules with helminths which infect the body-cavity of insects and the genital canals of snails and molluscs, are carried up into the clouds and scattered over the earth's surface in the form of worms, viz., the "mermis" and "gordius" or hair worm, which breed in damp earth and water, finding their way eventually into flies and moths which are found in human dwellings, when they often settle on man's food and drink.

These points therefore require careful consideration, because of the "monadinæ" ("cercomonas muscæ"), already referred to, as well as the flaws and defects in sanitation and hygiene, particularly in the "cancer fields," where there is a greater prevalence and mortality from cancer.

In affirming this, I feel I am largely supported in almost the whole of my contention, by the statements made on Cancer Mortality and the Summary quoted, which recently appeared in the *British Medical Journal*, as well as by works on this disease. That journal states, "It is not altogether easy to understand that the habits and diet of the people in different parts of the same country, can differ so greatly, as to account for the difference in the rates" (of mortality).

I think that I have clearly shewn that they do, when considered together with the predisposing and exciting causes of cancer.

The *British Medical Journal* in quoting Impey, with regard to leprosy, says, "It must, in the first place, come into contact with a person specially prepared to receive it, by external conditions or constitutional debility; it thus remains quiescent until stirred into activity by an exciting cause, until which time it circulates harmlessly in the lymphatics." To this statement, in its application to cancer, I would add the following:—*That as long as the external and internal conditions favourable to cancer, together with the pabula and ferments created by habits that lead to defective digestion and excessive consumption of alcohol (chiefly malt liquors), are kept up; or the person lives in an atmosphere of a beer distillery, as it were, charged with ferments ready to act as soon as the tissues and cells can respond, cancer is liable to develop.*

Removal from such surroundings and conditions of life which create dyspepsia, diarrhœa, dysentery and other chronic infectious

diseases of a similar pathogenic type, seems to afford the best chance of starving or destroying the parasite of cancer, if the pabula be withdrawn. Tea, properly made, and not pure tannic acid, is a drink to be encouraged rather than alcohol and beer, since, with it, physical exercise and endurance are better maintained with health and vigour at the same time; whilst the excretory and secretory functions are not disturbed and dislocated by loss of nervous control and lessened vitality generally. When these are deranged, the *materies morbi* of cancer have the best chance of entry into the human body. The abolishing of certain duties on tea, which has become almost a necessity of life at the present time, would enable the consumer to have an article in place of alcohol and beer, which sustains vigour and life by preventing loss of nervous control and lessened vitality, and thus warding off cancer.

XXVI.

Treatment.—The treatment of cancer resolves itself into the preventive and curative methods. In carrying these out, it is necessary to take into consideration all the conditions above-mentioned which bring about changes in the physiological secretions and excretions, particularly in the middle period of life or “menopause,” creating precancerous formations through functional disturbances in which ferments form. These, by long continuance of habits including the alcoholic, in which early and proper treatment is also neglected, must lead to loss of general vitality through loss of nervous control. Complex organic acids form which become chronic irritants and solvents of tissues and cells; arrest healthy metamorphosis of tissues and cells through alcoholic excess, impure water, food and bad habits, causing a heaping up or elaboration of unsuitable chyle, which creates the *materies morbi* of cancer and new growths. These turn malignant through the action of putrefactive organisms and nitrification so long as the pabula and ferments continue to be supplied. Thus the local manifestation through a general blood dyscrasia in which the new growth assumes the place of a separate organ, as it were, (Nature’s method of casting off, when the organs of excretion fail, and the loss of balance between absorption and elimination is disturbed or dislocated), causes a suitable nidus for further elaboration.

Certain flaws and defects in sanitation and hygiene bring about such parasitic invasion at certain periods of life, accidentally as a rule, and wherever suitable or favourable conditions are offered in certain districts in predisposed persons. Loss of nervous control and lessened vitality generally together with certain habits including the alcoholic, have a large share in determining growths such as cancer.

A. PREVENTIVE TREATMENT.—The points to be considered in the preventive treatment of cancer are the following:—

1. Defects in the Construction and Sanitation of Buildings in the “Cancer Fields” or Districts.—Cancer is a growth which is peculiar to tem-

perate regions, capable of forming under certain conditions at the middle period of life or "menopause" in women through defects and flaws in sanitation and hygiene, together with the other causes already enumerated.

It creates a high mortality in certain districts known as the "cancer fields," which have certain natural and physical characters said to favour cancer generation and mortality, as well as artificial defects or flaws in buildings, known as "cancer haunted" or "infected," which tend to encourage contagion or invasion by cancer. Such invasion is the more readily carried on in certain constitutions (either inherited or acquired), in which parasitic organisms (vegetable and animal) play a great part under favourable circumstances. Chronic infectious diseases, leucocythemia and leukæmia, brought about by lowered vitality generally, through loss of nervous control at the middle period of life, are the predisposing causes of cancer, in my opinion.

As in malaria, so in cancer, if the patient continue to live in such surroundings and conditions, the disease might continue, unless properly treated. In a tropical region where malarial fever is rife, malaria and its complications will set in and continue *as long as the pabulum and ferment continue* to be supplied. Quinine and antiperiodics might be successful for a time as palliatives; but the patient is still liable to malarial attacks. Under such circumstances, (1) *removal from the area whence the disease is contracted, is the first step in the treatment*; (2) the next, is *the removal of certain habits, including the alcoholic*. In cancerous affections the same applies, insomuch as the "*causa causans*" is the means of support to those organisms or germs, which are the "*causa vera*" of cancer.

As in the treatment of malarial fever, insect life (mosquitos) must be destroyed, or the person protected from bites by sleeping under mosquito curtains, or by fine wire netting fitted to doors and windows of houses; so in cancer, every possible vehicle of conveyance of the parasite by chance through insect life which is one of the channels of such transmission, must be dealt with in cancer fields particularly, by excluding flies and other insects from a dwelling—especially from parlours, kitchens, and breakfast rooms—which should be fitted with fine wire gauze or netting to the doors and windows.

Animals, such as horses, dogs, cats, poultry and also rats, which live in or near our dwellings, must be excluded (rats to be destroyed by fire) as much as possible; but if allowed indoors, must be kept scrupulously clean and free from fleas, lice, &c., by washing and grooming daily, and occasionally by washing with a weak solution of corrosive sublimate (1 in 20,000 in solution).

Stable litter and urine, which attract insect life to stables where dogs often wander and eat dung, should be swept clean, and disposed of by incineration or burial with lime and corrosive sublimate, and the stables washed with corrosive sublimate lotion (1 in 1,000 in solution).

Plant life, such as "sphagnum" or bog moss, with other mosses, should not be allowed to grow on walls in the interior of houses, or near water cisterns, tanks, or reservoirs, for reasons already given,

since they harbour the humblest forms of animal life (infusoria), which contaminate the drinking water.

The floors of houses should be free from dust, and a weak solution of corrosive sublimate used for washing them periodically.

2. *Water-supply*.—The conditions above mentioned, which render a house insanitary, require scrupulous attention on the score of cleanliness, as well as to protect the food and drink, including the drinking and bathing water-supply, from parasitic life.

Drinking water from open rain-water cisterns and reservoirs encourages the growth of the lowest forms of plant and animal life in the presence of heat and sunlight, since the warmth of sunshine creates the growth of the "*protococcus pluvialis*" (chlamydomonas), which flourishes at certain seasons of the year, when a green frothy substance appears on the surface of the water, indicating fermentation, which brings about the appearance of "*wheel animalcules*" (rotifers) whose body cavities are full of "monas" and "vibrios," which, on entering the human body, set up changes, causing dyspepsia, diarrhœa, &c., leading to anæmia and leucocythemia, whilst in some cases, it encourages skin diseases and entozoa. These create chronic irritations and inflammation, which if continued, lead to chronic infectious diseases and cancerous growths, preceded probably by precancerous changes of the skin and mucous membranes of the digestive tract, as well as leucorrhœic changes in the generative organs of the female, which create anæmia and loss of vitality, with leucocythemia and leukæmia.

Filters, or boiling water which should be allowed to cool before being drunk are necessary, especially if the water is from a doubtful source. The conditions of life under such circumstances, demand a pure water-supply, free from any chance of contamination or pollution both for washing and drinking purposes.

Functional disturbances, created by unwholesome water and habits, might create organic changes and chronic infection with inflammation, which if long continued, lead to caseation, ulceration and growths through chronic irritation and the creation of complex organic acids, which act as ferments, and lead to putrefactive changes.

Bacteriology and the microscope, have revealed to us dangers lurking in our system, which only require an explosive cause for the local manifestation of a general blood dyscrasia. The ways of "monadinæ" and bacteria are mysterious, and it is only medical science which must come to the rescue in a case of sickness or functional disturbance, otherwise, if household remedies and "*nostums*" are used by the laity without proper medical advice (when they are excessively harmful), there is every chance of diseases of an obstinate nature being created by the introduction of parasites into the human body, which set up growths.

The "vibriones," which usually accompany "monads," are probably members of the vegetable world, and always appear when animal matter undergoes fermentation and putrefaction in the same manner as the development of the yeast plant stands in correlation to alcoholic fermentation.

There is a technique in medical treatment which is followed by

medical men, which the laity do not understand nor use skilfully towards a beneficial end, although the remedies might be at hand, and taken. It is this technique which is often neglected, and lays the person open to dangers which lurk in the system, through what are considered innocent remedies.

3. *Habits*.—In the East, and in the Tropics generally, the habits of the people are largely vegetarian. In cultivating the fields, and reclaiming jungle land, they come into contact with insect life and parasites of all kinds, mosquitos chiefly, whose bites create conditions in the blood which set up malarial fever, in some cases worse than others. If the inhabitants were not largely vegetarians, we should witness sthenic inflammation, abscesses, and probably growths of a malignant character, provided the conditions mentioned which are necessary for such, were present in the individual and his surroundings; but the changes we witness are more of an acute character, and lessened in their intensity, so far as malignancy and growths are concerned. In Europe, the conditions necessary for such growths are present in the habits of the people being *omnivorous* or largely carnivorous, hence, parasitic life which encourages precancerous changes and formations through chronic disease or infection (chiefly functional forms), has a greater chance of entering the body. Excessive cold or heat might check for a time, or destroy, such life; whilst a certain degree of either heat or cold, with moisture, encourages it if the conditions for their reproduction and multiplication are present in the host.

Certain diseases of the skin, and chronic infectious diseases, arise through bad hygiene and sanitation, and they seem to bear a relation to cancer owing to fungi which are present and common to them; also because of the presence of certain animal organisms found in mucus lumps and mucous membranes, in these complaints. In the same way as certain skin diseases and entozoa are found in the Tropics, in larger proportion where malarial fever greatly prevails, so fungi and animal organisms which enter through the habitual consumption of particular kinds of food, have a relation to chronic infectious diseases and cancerous growths. The one creates pyogenic, and the other, pathogenic changes leading to fever, abscesses and ulcerations in the one case; whilst in the other, to cysts, dropsical effusions and tumours of a benign or malignant character, in tropical and temperate regions respectively.

The influence of alcohol and certain forms of alcoholic drinks in excess, such as beer and wines, and their relative value in health and diseased conditions, have already been mentioned, and it is unquestionably owing to the chemical and physiological disturbances and changes which they create, which favour diseases leading to growths, through fermentation and putrefaction.

The consumption of shell-fish and such like articles of food, and of large quantities of meat (or nitrogenous substances), underdone, encourages chance invasion by parasites, which are harboured in particular diets. The effect of such parasites, which carry enzymes, ferments and ptomaines, is in some constitutions immediately manifest by a form of blood poisoning attended with "*urticaria*," which creates severe irritation which might go on

to severer changes, ulcerations and growths, if they were long continued and left untreated; but which disappear under proper treatment and care and thus prevent severer consequences ensuing.

The consumption of certain foods and drinks excites similar changes in some cases more readily than in others; and there are dangers of a remote character which lurk in the system until suitable conditions occur for a local manifestation of cancer.

Food and drink of all kinds need scrupulous attention, and if from experience and observation they are found to gender certain diseases, these warnings of Nature should be accepted as dangers that require care and attention before ingesting. A weak solution of corrosive sublimate used for washing such articles of diet before partaking of them, is in my opinion very necessary, especially with regard to visceral food (sweetbread, kidneys, tripe, &c.), although in some cases, pure water might be sufficient for the purpose. Food and drink in parlours and kitchens, &c., should also be placed under gauze or wire covers to prevent flies and insects from contaminating the same, either before or after being cooked. The reasons are obvious, and more especially is this necessary in "cancer fields," and it is worth the expense and trouble from a sanitary and hygienic point of view.

At the "menopause" or middle period of life, owing to a disturbance in the general metabolism, and through sedentary habits, the body is more sensitive to impressions. To appreciate any sensation, emotion or movement, the afferent and efferent nerve and the centre for reception of impressions (brain, spinal cord and sympathetic system with the ganglia) are necessary. At this period there are morbid impressions frequently created which alter the secretions and excretions through the nervous system, and so further the favourable changes in cancer by first producing precancerous alterations. Dyspepsia and diarrhœa, and certain skin eruptions also, are often created by loss of nervous control or action. Certain organisms flourish when peculiar forms of these diseases, together with choleraic diarrhœa, dysentery, and phthisis, with chronic infectious diseases such as typhoid and typhus, are present. Peritonitis and local peritonitis, typhlitis, appendicitis, &c., are warnings of irritants from some local foci of infection, either mechanical, chemical, or bacterio-chemical at the points of infection or at a little distance from them.

Whether a lowered vitality and predisposition is not created from such complaints, even when cured, which renders the system in a manner liable to new growths and malignant disease if suitable conditions—such as those already discussed—are present, is one which is worthy of careful study. If we take the complications of enteric fever, we find that there is hypostatic congestion, pneumonia, gangrene of the lower limbs, parotid bubo, abscess, renal disease and bronchitis. All these seem such widely different classes of complications of organs far from the seat of disease, yet indicative of lowered vitality and circulation terminating in hypostasis through carriage of some ferment to a distance, which is under nervous control, and to solidifying of tissues through hepatization, which if not removed leads to further changes

of a pyogenic or pathogenic character (caseation, suppuration, and a breaking down or hectic) which leads to malignancy.*

In the formation of cancerous tissue, such changes are perhaps not as acute in character, but slow or chronic, and owing to this and to long-continued irritation, are perhaps more worthy of the term *malignant*, since they have got a thorough hold on the system and are more difficult to dislodge because the organisms have fused with the cells of the structure invaded, elaborating morbid materials in the same by a slow process, which is progressive, and an up-building through cell proliferation and micro-parasites.

Want of sufficient sleep, undue exposure to night air and inclement weather, are also disturbers of the nervous system and balance, hence it is necessary to bear in mind the effect for good or for evil on the process of digestion, and all those other organic normal processes which act in unison for the maintenance of health. "What is food for one is poison to another" is a wise saying to bear in mind; but what a man could digest without much harm if he had enough sleep and were not over-fatigued or exhausted, he could not manage to digest and elaborate into suitable chyle if he were mentally and physically weary. Mental worry creates mental and physical weariness which bring on conditions for the elaboration of materials suitable for diseases such as cancer, especially in the presence of the alcoholic habit and by chance infection in cancer fields. *Mens sana in corpore sano* is a motto to observe for the preventive treatment of all diseases, and particularly for cancer at the middle period of life or the "menopause."

Habits in life are the agents largely responsible for badly elaborated chyle out of materials obtained from the external world. Their correction, though difficult, is very essential at an early period, and when disease either functional or organic threatens, skilful and proper medical treatment are necessary and not the "*nostrums*" habitually used, whose ingredients are a *secret* and *most probably harmful* to the individual. After all, it is not the disease which is treated, but the individual who has taken the disease through some particular channel which the medical observer alone can correctly ascertain and diagnose, applying the appropriate remedy in suitable doses at the proper time.

B. CURATIVE.—It would be most difficult here to mention any particular specific for the cure of malignant growths such as cancer for reasons which the natural history and the complex processes in its creation suggest. It is the patient and not the disease which has to be treated. The particular forms of cancer in different individuals are the results of certain peculiar diatheses created or inherited, or of one or more diatheses, which have to be fully investigated and considered ere the treatment is begun and their causes ascertained and dealt with.

The general history, family history, past and present condition,

* What the typhoid state is to certain infectious fevers, malignant changes are to new growths, which turn to cancer. The anæmia and lymphocytosis following typhoid states are preparations for malignant changes and growths, hence the complications and sequelæ of typhoid are most important phenomena to check and to treat early towards a complete recovery.

and the present state, together with habits, have first to be inquired into before the treatment. These are points which help to focus the channel of entry and the changes which have probably occurred, as well as the powers of the organs to combat the disease, and which need adjuncts for their assistance in proper time.

The tongue, the skin, and the nervous and circulating system are guides to the portals of affection, and to diagnosis, prognosis and treatment. We cannot therefore do better than study these most carefully as mentioned by Ringer in his "Handbook of Therapeutics," especially in the opening chapters devoted to the tongue, skin, temperature, the theory and action of acids, alkalies and baths in health and disease, for they are incontrovertible medical and therapeutic testimony of facts gained by experience and experiment, and a masterpiece of learned logic the "A B C" of the art of diagnosing and prescribing, as well as the art of healing.

The external body as well as the internal organs need to be cared for and preserved from impurities through external as well as internal causes which are constantly at work. Disasters and victories are the result of this change, "constant change," in our system.

Precancerous changes, or functional disturbances leading to such, are evident through the tongue, skin, temperature; and these together with the nervous system, require foremost attention *per vias naturales*, before we can hope to produce beneficial results with drugs directed in their action towards a specific cure or arrest of cancer in any organ or part. The knowledge of the individual who might have suffered for months from anæmia, leucocythemia, or dyspepsia and the complications of other diseases due to a particular cause, in residence, locality, or habit, requires early treatment, for without the removal of the early cause of the complaint, we scarcely can expect any other result than the keeping up of chronic irritation. Removal of bad habits is as essential as the removal of the patient from a bad residence, and the two together might imply removal of the cause partially—it is attacking the enemy from the centre as well as from the periphery—in other words, forcing surrender, with as little harm, and probably with beneficial results to the patient eventually. Late hours, over-fatigue and exhaustion (mental and physical), excessive alcohol, and excessive smoking of a foul pipe or impure tobacco, have all to be considered in treatment for the removal of the factors in the causation of disease.

The *primæ viæ* require proper attention, and any liability to disturbance of the alimentary tract, or the presence of entozoa, must be carefully removed *secundem artem* for the purpose of restoring physiological co-ordination and balance through the secretory and excretory organs, and thus re-establishing the general health to enable it to weather the elements once more should occasion arise. The human being like the ship at sea, is subject to the action of the elements and waves, a constant pulsation, throbbing and action; carried now forwards, now backwards; but ever ready to breast the storm if the steering and management are skilful, the

crew strong and equal to their task which comes of endurance and a level head.

C. THERAPEUTIC.—All functional disturbances, constipation, dyspepsia and diarrhœa, anæmia and leucocythemia, require to be watched, in "cancer fields" especially.

The blood in anæmia and leucocythemia requires to be examined carefully under the microscope, and the changes noted and treated with appropriate remedies.

In all forms of anæmia or leucocythemia, it will be found that the proper technique is the thorough cleansing out of the "*primæ viæ*," without which the subsequent treatment with iron preparations is not of much permanent benefit, for the patient lapses into his former condition shortly after. We should not think of giving iron preparations to a person suffering from tape- or any other worm of the intestines, without a vermicide or vermifuge first, when the administration of an iron preparation would then do good. Why then should iron preparations be given to patients suffering from such conditions as anæmia and leucocythemia—which are, in my opinion, the preparations in the soil for other serious diseases—without first clearly ascertaining whether there are entozoa in the intestines or parasitic organisms in the blood and tissues? We know from experience in the Tropics that quinine and other antiperiodic remedies do far more good, and act more efficiently, if the bowels be first acted on by a dose of castor-oil or other purgative. In the Tropics I consider that castor-oil is the best purgative previous to treatment with quinine, for the simple reason, that it very often without the aid of a vermicide, will expel a nematode worm from the intestines by blocking up the breathing pores of the parasite and so destroying it. After its expulsion, quinine, or quinine and iron, destroy the parasites in the blood corpuscles. In the case of children, castor-oil is safe and efficient, and the child soon looks quite a different being in twenty-four hours; eats and sleeps better; is more lively and healthier in appearance.

In the case of adults, in Europe, it is necessary to use preparations of mercury as a purgative, they act on the liver, and are destructive, even in small quantities, to "*monadinæ*" in the intestines. The perchloride (corrosive sublimate) and the iodide of mercury, are excellent preparations on account of the properties they have in destroying parasitic life, and owing to their action on the liver, which is a great advantage, since these parasites are often concealed or take refuge with threadworms in the bile duct, into which they wander or bore their way through sometimes from the bowels. Subsequent to a mercurial preparation being given, castor-oil is useful, as it thoroughly cleanses the "*primæ viæ*," after which the preparations of iron are useful. The appropriate preparation depends very much on the patient's powers of assimilation and condition of health and organs. If there be no complications such as enlargement of glands, or of the nervous system indicative of loss of nervous control, the ordinary perchloride preparations are useful; but in the case of affections of the lymphatic channels and glands, the iodides of iron, the syrup of hypophosphite of lime, the hypophosphites of quinine,

strychnine, iron and magnesia, or the phosphate of iron with phosphoric acid in the case of the nervous system demanding the introduction of phosphorus at particular periods of life are needed. Bromide of iron is useful if there be sleeplessness and insomnia with *bruit de diable* due to hydræmia. It is not the quantity of iron preparations but the amount assimilated which is useful to re-establish the healthy state of the blood and to carry oxygen to the tissues. The particular preparations are given in particular states of the system which demand early and proper measures.

I feel sure, that parasites of the intestines and helminths are responsible for a great deal in blood alterations, by creating an impoverished condition of the blood corpuscles and altering the general metabolism of the system by creating ferments that do harm by encouraging parasites to enter and become stationary. The system therefore needs to be cleared periodically of such impurities, and the skin maintained in a healthy state by baths, friction and good soap.

The urine needs to be also tested in such conditions and the effete products examined (qualitative and quantitative analysis), checked or brought to a healthy standard, particularly as to parasites (which might be passed) and the alloxuric or purine bases.

Increase of adipose should be gradually diminished when they are in excess of the physical relative equivalents (height, chest, girth, and weight). All nitrogenous, saccharine or carbohydrates, fats or hydrocarbons should be ingested in healthy proportion to prevent such changes at the middle period of life, when there is a tendency to degenerative growths and fatty metamorphosis of tissues. Alcoholic habits and excessive consumption of beer must be checked to prevent the ill effects already mentioned.

Excessive smoking which lowers the circulation and depresses the heart, creating the teeth indented tongue and "leucoplakia" with minute lesions and bad teeth, as the result of dyspepsia and derangements of the liver, should be checked. A foul pipe saturated with acid mucus which is applied to the mouth several times a day, must be injurious to the digestive functions by altering the secretions in the first act of digestion by paralysing the nerve endings in the papillæ.

All pipes should be kept scrupulously clean and free from fungoid growths, which must form in some cases through acid saliva in the stems of pipes which are laid aside for weeks and then used. The use of the tongue scraper—a U-shaped piece of silver or whale-bone—especially in the case of habitual smokers, is a useful article for cleansing the surface of the tongue by scraping away all mucus and epithelioid concretions which collect at night, in a confined room particularly. This article, in addition to a suitable dentifrice* and tooth-brush, is a very necessary thing to use daily first thing in the morning and last thing at night, for the prevention of precancerous changes.

* Charcoal powder with camphor (powdered up) is the best dentifrice to prevent decomposing tissues from creating acids and ferments, as well as for cleansing the teeth.

The skin also needs attention with baths. Tepid baths with plenty of suitable soap (for cleansing the skin and freeing its surface of the fungoid growths which accumulate in the pores with insensible perspiration mixed with other substances from the air), are very necessary. One of the best soaps for this purpose is one made of castor-oil with peppermint oil, for it not only cleanses more thoroughly, but is destructive to fungoid and parasitic life, nourishes the skin and prevents insects from settling on the surface and doing mischief by their bites. In summer it has the advantage of keeping the skin cool. A Turkish bath occasionally is also to be strongly advocated.

The skin, alimentary canal, and kidneys are three of the principal systems which require scrupulous attention as regards cleanliness and proper order.

The other organs also require as much care, together with the organs of generation in the male and female, for reasons which do not need to be explained in detail.

Serum-therapy.—The various extracts made up from organs, such as thyroid extract, have gained a reputation of late owing to the changes which they produce in the system by reducing enlargements and new growths to a normal condition. Their secretions or excretions have lately been discovered, and iodine found in different forms in the thyroid gland, which seem to have a powerful influence in restoring the balance and altering the general metabolism of the system towards a favourable end. We are told, however, that thyroid antitoxin is not an albuminoid, but probably a derivative of *guanidine* (Ringer).

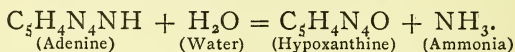
It is well here to remember the relation of the nucleins and nucleo-proteids and the decomposition of nucleic acid which yields phosphoric acid and various bases of the xanthine group (the alloxuric bases).

The principal conditions which lead to an increase of uric acid in the urine are :—

1. Increase of meat diet and diminution of oxidation processes such as occur in people with sedentary habits.
2. Increase of white corpuscles in the blood, especially in the disease known as leucocythemia. Leucocytes contain large quantities of nuclein. Nuclein yields nitrogenous bases closely related to uric acid.

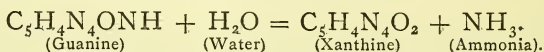
These bases (the alloxuric and purine bases) may be arranged in two pairs :—

Adenine ($C_5H_5N_5$); on heating with sulphuric acid, NH is replaced by O and hypoxanthine is formed.



Both substances contain a radicle $C_5H_4N_4$, called *adenyl*; adenine is its imide, hypoxanthine its oxide.

The following shows a similar relationship between the other pair of bases *guanine* and *xanthine* :—



Certain diets lead to increase of uric acid formation by leading

to an increase of leucocytes and consequently increase in the metabolism of their nuclei.

Owing to the peculiar forms of leucocythæmia mentioned by me in the previous pages, it is necessary to obtain the serum of such cases from the blood of patients, as well as from the lymphatic glands by preparation of an extract which would probably produce a far greater influence in the cure and dispersion of cancer than thyroid extract. Whether *guanine* would not cause a dispersion more readily than thyroid antitoxin which is a derivative of *guanidine* (Ringer), I feel sure that its influence would be powerful.

The serum from rodent cancer cases and those from lymphadenomata might contain substances—judging from the life-history of cancer—which would render the individual immune, or cure such as suffer from the more virulent or malignant forms of cancer (dermoid and organic).

The substance from the lymphatic glands in the near neighbourhood of the disease seems to be the one for preparing and attenuating.

If animals are used for experimentation in cancer, it is necessary to have such as could be of the right age (old animals) for experimentation; but without creating a leucocythemia as is present in “cancer fields,” we cannot hope to produce cancer in the lower animals. The serum obtained from such cases would most probably prove valuable in the treatment of leucocythemia, lymphadenoma and cancer, which would have a more beneficial effect than thyroid extract owing to the derivative from *guanine*.

Iodine and iodide of potassium, sodium, and ammonium are drugs worthy of more extended and persevering trial in cases of cancer and precancerous changes, for reasons not far to seek, in *appropriate doses* and at the right moment.

